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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

First Annual Meeting of the Michigan Gas Association.

THE MICHIGAN GAS ASSOCIATION,
SAGINAW, MICH., Feb. 5, 1894.

The first annual meeting of the Michigan Gas Association will be held at Grand Rapids, on Wednesday, February 21.

The meeting will be called to order at 8:30 in the morning.

A list of the papers to be read will be published later.

HENRY H. HYDE, Secretary.

[OFFICIAL NOTICE.]

Twenty-Fourth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY, LYNN, MASS., Feb. 10, 1894.

The twenty-fourth annual meeting of the New England Association will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21 and 22. The meeting will be called to order at 10 o'clock on Wednesday morning, February 21, by the President, Mr. C. H. Nettleton, of Birmingham, Conn.

The programme of the meeting will consist of:

The President's Address.

Report of the Committee on the "Effect of Electric Railway Return Currents upon Gas Pipes," W. R. Addicks, Boston Gas Light Company, Chairman.

"Advantages of a Combined Coal and Water Gas Plant," by C. J. R. Humphreys, Lawrence Gas Light Company.

"The Storage and Measurement of Enriching Oils," by W. E. McKay, Bay State Gas Light Company.

"Lime Boxes for Removing CO_2," by N. W. Gifford, New Bedford Gas Light Company.

Topic for Discussion.

"What value can be derived from coke and tar, if used for retort firing, steam generation and in Water Gas Generators," lead by Messrs. Sherman, Fowler and Lamson.

Members are requested to bring results obtained, particularly on the latter points; the discussion of questions from the Question Box, and the consideration of other papers partially promised, and of such matters as may be brought before the meeting. A prepayment meter will be exhibited.

The members will, as usual, dine together on the evening of Wednesday, February 21, at about 6 o'clock.

Indications point to a full attendance and an interesting meeting. All members are requested to attend, if possible, and to take an active part in the questions to be considered. C. F. PRICHARD, Secretary.

BRIEFLY TOLD.

THE NEW ENGLAND'S PROGRAMME.—Before our next issue is in the hands of our readers the 24th annual meeting of the New England Association will have been held and then the current gas year can be said to be completely underway. As will be seen from the last notice of Secretary Prichard, and in conformity with our predictions of a week ago, the literary part of the proceedings is to be fully up to the standard hitherto enjoyed by the Association. Some may be inclined to the belief that the paper list is rather scanty to carry the Association over a two day session; but, in our belief, the four numbers—comprising three set papers and the report of a special committee—catalogued, together with President Nettleton's address, will furnish ample matter for interesting and instructive debate. Possibly the report of the Committee on the "Effect of Electric Return Currents upon Gas Pipes," which has been prepared under the cool and methodical direction of Mr. W. R. Addicks, will excite the greatest interest, for the rapid extension of the use of electric currents for propelling street railway cars has undoubtedly caused much damage to the mains of gas companies in every instance where electric propulsion has gained a foothold. Perhaps this is so more particularly in respect of Brooklyn, N.Y., than of any other city, although it cannot be denied that in Mr. Addicks' own city he has had plenty of examples wherewith to point his story. Mr. C. J. R. Humphreys, who is to recount the "Advantages of a Combined Coal and

Water Gas Plant," certainly can speak by the book, since he has had much experience in the practice upon which he is to dilate. Further he is always thorough, and is never over enthusiastic. Mr. W. E. McKay, who has appeared as a paper contributor before, and who has more than once prepared readable and studious articles for the JOURNAL, has selected a live topic in "The Storage and Measurement of Enriching Oils." The amazing quantities of oils absorbed the country over for this purpose require much care from the gas man, in that he is called upon to so store them that the local authorities are kept from objecting to their presence in crowded districts, while disposing of them at the same time in a manner that will enable his Company to use and convert them with convenience and economy. It is a complex problem, and Mr. McKay's presentation of it will undoubtedly hold the attention of the Association. Mr. Gifford seems to be the possessor of courage at any rate in attacking the subject of "Lime Boxes for Removing CO_2," but it is safe to claim that he will have something new to say about this old time aid to discussion. As before remarked, when these topics, in addition to Mr. Nettleton's annual message, have been fully considered, there can be no differing opinion in respect of the merit of the technical part of the proceedings. We can endorse Secretary Prichard's remark that "Indications point to a full attendance," for we know that this vicinity will be represented by at least a score of good men and true.

THE CONTENTION OF THE CAPITAL CITY GAS COMPANY, OF DES MOINES, IOWA, SUSTAINED.—The proprietors of the Capital City Gas Company are to be congratulated over the outcome of their contention with the local authorities that the ordinance passed by the latter in 1892 reducing the gas rate to a figure less than the one prescribed in an ordinance passed in 1885, which was to last for 10 years, was illegal and not binding. "It is held by Judge Conrad," to use the words of a correspondent, "that the original ordinance fixing the price of gas at $1.70 per 1,000 cubic feet is a contract, and the city is bound to carry out said contract with the Gas Company. The ordinance fixing the price of gas at $1.30 is therefore null and void, as was the one before it which fixed the price at $1.15. The Court in the latter case held that the price fixed by the ordinance was not a fair compensation, and also that the contract of the city to pay $1 70 was binding. The ruling in the present case is practically the same. The case just decided was brought about by the refusal of the Des Moines National Bank to pay for gas billed to it at the rate of $1.70 per 1,000, although it confessed its willingness to settle on the price named in the newest ordinance—$1.30 per 1,000. The Gas Company instructed its employees to remove the Bank's meter, whereupon the latter asked for an injunction restraining the proposed removal. The city also intervened and thereby became a party to the action, and is bound by the decision of Judge Conrad. The $1.70 rate will accordingly obtain, unless the Supreme Court reverses the opinion of the District Court, as it has been determined by the parties in interest to take the case to the Court of last resort."

DEFEAT OF THE CHICAGO GAS JOBBERS.—That precious collection of political flotsam and jetsam which stands for the City Council of Chicago, signalized itself some days ago by granting to the projectors of the Metropolitan Gas Company a franchise that was deeper than a well and broader than any church door which swings on hinges in the Windy City. The manner of its passage was of the boldest type, for no attempt at justifying the iniquitous measure was offered. It was simply a case of barefaced rascality. The promoters of the "Company" were granted everything they asked; in fact, the franchise was an unconditioned one, and would have been most valuable to its holders for the possibilities which it offered as a means of attacking the treasury of the actual gas interests of the city. We are glad, however, to be able to say that Mayor Hopkins vetoed the monstrosity, and the schemers were subsequently unable to secure the necessary votes to pass it over the Mayor's objections.

NOTES.—Mr. J. L. Hallett has resigned his position with the Portland (Ore.) Gas Company, much to the regret of the Company, which has benefited so greatly by his management of its affairs. His successor is Mr. C. F. Adams, who has been with the Company since its reorganization in 1892.——We are in receipt of a beautifully compiled pamphlet, issued by Messrs. Perkins & Co., of this city, which tells the story of the "Gas Coal Deposits on the Line of the Clinch Valley Division of the Norfolk and Western Railroad." Messrs. Perkins & Co. are the tidewater sales agents for these gas coals, and their acceptance of the agency is a good guarantee that the quality of the material is all right. The pamphlet is beautifully illustrated, and carries among other plates two maps showing the location of the mines, that are models of the map maker's art.

Coke.

[A paper read by Mr. C. K. Pitman, of Chicago, before the Western Foundrymen's Association.]

In the year 1849, Overman, in his book, "The Manufacture of Iron," said: "As there is but little prospect of an addition to the number of coke furnaces which now exist we shall devote but a limited space to this subject." The value of coke produced at that time was about $15,000. In 1891 the output was about 10,350,000 tons, with a valuation of over $20,000,000. This marvelous development is due to the superiority over other fuels for iron working. There are other fuels that are better than coke for some specific purposes, but no other unites to so great an extent the qualities needed in the reduction of ores and the melting of iron, and I may add for domestic purposes.

The coal deposits from which is made the coke we use here are found in the States of Pennsylvania, West Virginia, Virginia, Kentucky and Alabama. The latter produces about 13 per cent. of the total output, but its use is confined wholly to the South. In the far West the Colorado field, as far as now known, is the most important. Her smelting and iron works are supplied wholly from her own ovens, and while this coke is not equal to that of the East, there are still undeveloped deposits of coking coals that will before long furnish a fuel of the best grade.

The coke that comes to this market is produced in the three States first mentioned, and in a general way may be classified as the Connellsville from Pennsylvania, coke from the Fairmount region of northern West Virginia, New River and Kanawaha cokes from the central and western part of the same State, and the Pocahontas coke from the southern part of Virginia and West Virginia. There are many other cokes not included in this general classification. The area of the coal deposits from which these cokes are made is so extended that there is a wide diversity in quality and characteristics. They range from the bad to the excellent, and it requires considerable knowledge and experience to pass upon their merits.

It is surprising to find how limited is the knowledge of coke, not only among people in general, but even among those who from the nature of their business should be informed. It is more curious that so few of those who manufacture coke have an intelligent understanding of the product of their ovens.

The history of the production of iron and steel shows a wonderful development, preceded and attended by careful and scientific investigations. In the manufacture of coke we are using essentially the same methods that were used at the beginning of the industry. Little effort has been made to lessen the enormous waste of fuel or to discover the means of making the product more uniform and effective. Within a very few years there has been a movement in this direction, and though comparatively little has been accomplished there has been a decided gain. Generally speaking, European practice is in advance of ours.

To what extent the quality of coke can be improved is a question. My own belief is that it can be greatly benefited by better methods. So long as we have an unlimited supply of coking coal the need of better methods of manufacture will not force itself upon us. The production of some of the very best coke regions has already begun to diminish. The needs of the iron trade forced the use of low grade ores that had been esteemed wholly useless. The same condition of affairs will affect the coke industry. Coals that now produce inferior coke must revolutionize their process, and competition will oblige the purer coal to follow in a measure the same course. We have already come to recognize one fact, and that is that the same methods will not apply to all coals. Variety of coal requires variety of coking if uniform results are to come. In one of the coke regions referred to above a number of the operators made so poor a coke that their sales dwindled to the starvation point. Instead of giving up the battle they called to their aid the help of the chemist and the engineer. They changed their methods radically, and to-day an increased output and larger sales with much more satisfactory returns are the result.

The mechanical process of making coke as now in use is too well known to need more than passing mention. This fuel is obtained by the expulsion of the volatile constituents of coking coal and a portion of the impurities through the action of heat, leaving behind all of the fixed carbon and sometimes more, together with the earthy constituents, as an ash. It is rather distillation than combustion. The quality of the coke depends primarily upon the character of the coal and upon the skill and judgment of the coker. Under the present methods a good coal can turn out a poor coke, but a poor coal can hardly produce a good coke.

The burning continues for 48 hours for furnace and 72 hours for foundry coke. For foundry use it is generally thought necessary to

have the 72-hour coke. I do not think this belief is well founded. Furnace coke for general use gives as good results in the cupola as the foundry coke. For special purposes the harder coke may be needed.

The objection to the black ends is largely a prejudice. To test this the manager of a large iron foundry had three cars of black ends coke sent to the works. The foreman promptly reported the arrival of the bad coke. To his astonishment he was instructed to accept and use it. Puzzled and unwilling, he did so. The black ends were used and the results were the same as with gray coke.

All coals contain more or less sulphur, and many phosphorus. To reduce these two substances to the minimum is a constant labor. The sulphur occurs to a greater extent than phosphorus, and its elimination is one of the problems of coke making. We may say that the amount of phosphorus is so small in the better class of cokes that they need not be considered. That sulphur is a deadly enemy of iron nearly all foundrymen are agreed, yet some good authorities claim that in a general way a certain proportion of sulphur improves the iron, making it stronger and more fluid without weakening it. How far this is true is very uncertain.

The ideal coke for foundry use is one that has the greatest amount of fixed carbon, a cellular structure that is strong enough to carry the burden and produce the most perfect combustion, has no ashes in excess of what is needed to insure the most efficient work, and is free from those substances that will change the character of the metal and weaken it.

Our knowledge of the chemical changes that coal undergoes when converted into coke is meager, and until they are known we cannot produce that best fuel that we are seeking. Yet many of our cokes approximate to it. The necessity for scientific methods based upon accurate knowledge is becoming more apparent. The importance of correct analysis of fuel is recognized. Every step in blast furnace practice is based upon the analysis of the chemist. A similar course is of advantage to the foundrymen, modified by the different conditions, but it must be joined to good judgment and experience.

It has been said that figures will not lie, but the figures of a coke analysis do frequently deceive, partly because the analysis may not be correct and partly because we may only imperfectly understand what it says. The analysis of coke is too often deceptive, because the sample is not properly selected and is not an average of the fuel. Therefore it may show the coke to be poorer than it is or better than it is. Probably the latter is more often the case. The method of the analysis may be wholly correct, but the theoretical conditions under which it is made may not show what it can do in the foundry unless we know enough to read between the lines. The analysis that gives the total amount of ash on a coke is not always sufficient. The constituents of the ash are as often as necessary, since they may be of such character as to produce a change in the molten iron and may have more or less bearing upon the flux that should be used. There is from time to time some variation in the same coke that results from the varying conditions attending the burning, and some variation in the coal. What all these small variations are that produce this effect we do not fully know. It results from this that more than a single analysis is desirable.

The cokes that come to this market and to the West generally show a wide diversity in the analysis. This may be the case and yet all the cokes may be good in their proper places. They contain from 87 per cent. to 92 per cent. of fixed carbon, from 6 per cent. to 12 per cent. of ash, and sometimes as high as 17 per cent., and from 0.6 per cent. to 1.25 per cent. of sulphur.

For foundry use the higher the percentage the better, provided it does not contain too much sulphur. The amount of sulphur that can be safely used seems to be uncertain, or rather opinions and results vary. The general belief seems to be that 1 per cent. is the maximum, but I have heard men of much experience say that 1.25 per cent. is the limit. The cokes most generally used here contain from 0.75 per cent. to 1 per cent.

The proper amount of ash is an unsettled question, and the belief seems to be gaining that while too much ash clogs the work, it is as bad to have too low an amount as too great. The constituents of the ash are undoubtedly a factor to the question. With our limited knowledge we may say that probably there should be a suitable balance of proportion of all constituents of coke, and we know that the character of the iron and the flux are factors in the problem. We do not understand very fully the cellular structure of the coke. Upon it, however, depends the strength and also the perfectness of combustion. Whether it can be varied and what amount is best is, I think, an unsolved question. A gentleman of much experience claims that he can vary the structure of the coke at pleasure. It certainly is modified by the preparation of the coal—the more finely divided the coal the more dense the coke. It is also influenced by the amount of volatile matter in the coal or by the amount of free hydrogen.

It is evident that there is a wide field for research in the coke industry. It is gratifying to see that the belief that any coking coal, a bee hive oven and the application of heat, must turn out a salable coke, is weakened of late. It is but just to say that there have been some notable exceptions among coke manufacturers. The average of coke to-day is certainly higher than it was a few years ago, but this does not mean that there is no need of greater and better results. The average of American cokes is higher than the average of European cokes, though the best of the English coke is probably more effective than our best. The richness and extent of our coal fields, the comparatively good fuel that comes from our ovens with the minimum of trouble and expense, has withheld the incentive for improvement that exists in so many other industries.

From one point of view the use of coke in foundries is a small question, but when we consider the great variety of ores and iron, the same variety in fuel, the limited knowledge we have of the chemical and physical changes that are brought about in the cupola, and the interdependence of all steps leading up to the finished casting, the subject becomes a larger and complex one.

In the operation of a blast furnace, and in the whole process, from the mining of the ore to the casting of the pig and the finished steel, practical skill goes hand in hand with theoretical knowledge. The judgment of the worker is supplemented by the training of the student. I see no reason why in foundry practice the same conditions do not exist. Every experienced foundryman is a better workman when he adds to his practical training theoretical knowledge. This scientific training is but the practical knowledge of those who have gone before us classified, sifted and preserved for those who may use it. The foundryman who unites his personal experience with the experience of others, obtained by personal contact, within the walls of technical schools or from the pages of the book, will use his material most economically, will make the fewest failures, will secure the most uniform results; in short, will do the best work.

A somewhat extended experience has shown that it is a lack of accurate knowledge in much of the foundry work that is responsible for many expensive failures such as come so often, rather than inferior materials to which it is so often charged. There seems to be in this industry what has been so often, and I may say generally, found in all industries—a tendency to get into a rut. With reference to coke, there have been many amusing and many annoying illustrations of this fact. A few years ago, because of a strike, the coke produced at certain ovens could not be had, and new and untried cokes must be used. This new coke was used by three different foundries not far from here, all doing the same kind of work, under apparently similar conditions. One foundry reported the coke entirely satisfactory and continued its use. Another declared the fuel a total failure; that the iron was white and the castings inferior. The third foundry, located not more than 200 yards from the second, confirmed the experience of the first, and has continued to use the coke. Similar instances different in details but involving the same principle could be cited at length. What is the explanation? It would seem to be that there is a want of method, an absence of knowledge outside of the groove in which the work has been running. So long as the work is done in the customary way the results may be satisfactory, but if any of the conditions are changed the whole system is out of joint.

Another instance is a type of many. In a large foundry this test was made: A new coke was bought and put in for use. The foundryman objected to any change, and the new coke, though one of the standard brands, was pronounced unsatisfactory in most respects. Then the same coke was sent down under the name of the coke that had previously been used. Then everything went smoothly, and the coke was what was wanted. In both cases the coke was identical, as were all the other conditions.

From the time the ore is taken from the mine until the finished casting or forging leaves the shop, iron and coke are most closely connected. The former has been evolved by the application of all the chemical resources of science. The expansion of the iron industries has brought into use a great variety of ores and many grades of iron. To so great an extent is this true that a new grading of iron, based upon a chemical analysis, is urged. This fact brings out a point in the use of coke. From time to time complaint is made that coke is high in sulphur, making the iron white, hard and weak. In many cases the complaint may be just, but I am certain that in many others the coke is guiltless. The analysis of iron is fully as important as that of coke. A few years ago one of our large Western foundries reported that the coke sent to them was bad, and that it could not be used. An investigation made it clear

that the castings were bad, white and chilled. The same coke was in use at an equally large foundry at some distance from there. This foundry, while placing a just estimate upon the practical skill, had made it a rule that everything that went into the cupola must be analyzed and a record kept. This record showed that the coke had been all right, showing only the usual average of sulphur. Inquiry developed the fact that at the foundry making the complaint no such system of analysis was in use. The inquiry carried still further made it quite certain, to me at least, that the whole trouble was in the iron, though the coke bore the blame. Your own experience will probably furnish similar cases; sometimes it is silicon in the iron, sometimes it is sulphur in the pig, sometimes phosphorus and sometimes it may be the flux, but coke is often the vicarious sufferer.

The heart of the foundry may be said to be in the cupola. Most of the troubles that come originate there. There is no part of foundry work that demands such close and intelligent care. If the cupola is not in proper condition or not adapted for the work, if the iron is not of proper grade, if the coke is too light or too impure, if the flux is unsuitable, if the blast is too intense or too weak, if the supply of air is too great or too small, the effect will be seen in the finished casting. The overlooking of one small point may spoil the whole work.

To lay down a rule or set of rules for the use of coke in a cupola is not possible. The efficiency of the furnace depends upon the proper adjustment of the parts and the accurate working of all to one end. It is necessary to be personally acquainted with the cupola and the blast furnace. A man who was practically and theoretically familiar with a certain blast furnace once said, when many miles distant from it: "If you will tell me the condition of the atmosphere, the strength and direction of the wind at the furnace to day, I will tell you what grade of iron is being produced." This claim was in a large measure justified by test. The chemical reactions that take place in the cupola are imperfectly understood. We know enough, however, to appreciate the importance of a full knowledge of the constituents of iron and coke, and it may be added there should be a similar knowledge of the flux that is used. Only by such knowledge can the proper kinds and proper proportions be known. The use of an improper flux, and even an excess of a suitable one, may produce the same effect that excess of sulphur in coke or iron does. To what extent iron will absorb sulphur from the fuel is not known, but when the coke contains 1.5 per cent., and probably 1.25 per cent., the iron will be deteriorated. It is probable that a better understanding of the reactions of iron, coke and flux will make it possible to use without injury a coke higher in sulphur than is now thought possible. Some recent experiments have been made in this direction, but nothing definite has been reached. Apparent progress has been made, however, in methods for the elimination of sulphur from the molten iron, which may have a bearing upon our problem. Another factor in cupola work that most closely affects coke is the blast. It has been clearly demonstrated that the use of hot blast saves fuel, but the working of most foundry furnaces is so intermittent that its use is hardly feasible. It has seemed that too many foundrymen failed to appreciate the real necessity of the proper adjustment of the air supply that enables the coke to do its work. The pressure of the blast should be sufficient, and the amount neither too great nor too small. There is a waste of both coke and iron in either case. If the pressure and amount of air are not enough the melting will be retarded, the fuel will be consumed but will act too slowly, the metal is deteriorated, runs thick, and the castings are inferior. If the blast is too strong the coke is consumed too rapidly, and a portion blown out unconsumed. The intensity of the heat beyond what is needed hardens the iron, is apt to induce chemical action between iron and the impurities of flux and coke and cause the thin liquid slags to attack the lining. Thus the full value of the coke is utilized only with the proper intensity, amount and uniformity of blast. The blast, moreover, must be regulated by the character of the iron, of the coke and the flux. If the coke used is hard and firm the blast should be stronger than if a lighter and more porous coke be used. Many a good coke has failed because the blast was not properly regulated.

It is an error to suppose that sulphur can be burned out by intensity of heat. The analysis of gases escaping from blast furnace chimneys shows no sulphurous vapors, and I think none containing phosphorus. Upon the same principle, in burning coke about one-half of the sulphur of the coal is driven off if the heat is regular and not too intense. If it be too intense the sulphur seems to have chemical affinities developed that cause it to enter into combinations upon which the heat has no effect.

It will naturally result from what has been said that from inattention to details there must be a large waste of coke in cupola work. The loss through breakage in transit and careless handling is small compared to with that due to faulty methods. In England the average consumption of coke in cupola work is 280 pounds with a minimum of 175 pounds per ton of iron melted. In this country the best practice puts the minimum between 150 pounds and 225 pounds, though this is perhaps too small. What the average is I cannot say. In what has been said in a general and rather desultory way, the object has been not to criticize, but to call attention to those more obvious points in foundry practice that may be improved, as they appear to a layman. The use of coke is so intimately bound up with all other materials that enter the cupola, and one so depends upon the others that no rule of action can be formulated for one that does not apply to others. Considering coke alone we can say that so far as we now know it is the best fuel for the melting of iron in the cupola, because it is, as a rule, more pure and uniform, and, when properly used, will give the maximum of efficiency. When we ask what the best coke is we can hardly answer in a word. We must take into account the kind of work to be done, the iron to be used, the flux that is best adapted and the conditions of the blast. We must know in a measure what our iron contains, what are the constituents of flux and coke. We should know as much as we can of the chemical affinities and relations of these constituents. Then we can say with some degree of accuracy whether Connellsville or Pocahontas is best, whether New River or West Virginia will be most efficient and economical.

Electricity as Applied to Mining.

According to the *Colliery Engineer*, Mr. George Gould, foreman of the Cannelton mines, at Cannelton, Beaver county, Pa., in a paper read before the Western Pennsylvania Central Mining Institute, on the subject of electricity as applied to mining, confined himself principally to a study of electric mining machines. He called attention to the fact that the progress in the construction of mining machines has not kept pace with the progress made in ventilating mines, mechanical haulage in mines, etc. He deplored this fact, because he believed that machine mining meant greater economy and increased safety. He attributed the slow progress made in this line to the antagonism of many miners who foolishly think the adoption of machines will be injurious to them as a class. He called attention to the fact that labor saving machines invariably tend to better the condition of laboring men, and stated that as a good mining machine will enable a much greater area to be undermined per day, it will require more *good* miners to blast down the coal and set timber than are required or employed where hand mining is done. He held to the opinion that it took greater skill to blast down the coal and properly set timbers than to undercut the coal. Undercutting the coal by hand, he contended, was a laborious and disagreeable task. It caused a greater proportion of small coal than was made by machine mining and consequently less pay for the miner. Besides there was greater danger in undercutting by hand. He stated that mining machines were used in Scotland 20 years ago, but as far as he could learn they were not successful. Notwithstanding improvements in other branches of mining during the past 20 years, but little progress was made in the construction of a perfect mining machine, except during the past six years.

During this latter period, the utilization of electricity as a means of transmitting power in mines has stimulated inventive genius in this line, and there are now on the market electric mining machines which the manufacturers claim will undercut from 700 to 900 square feet per day of 10 hours.

The first of these to which he called attention was the Jeffrey machine, manufactured by the Jeffrey Manufacturing Company, of Columbus, O. It is a strong and powerful mechanism, and, in his opinion, ranked first in point of efficiency. There are over 100 of these machines at present in operation. It undercuts the coal to a depth of from 5 to 6 feet, making an undercutting 4 inches in height. It will make the undercut in the fireclay bottom, if desired, thus effecting considerable saving in coal. It makes very little small coal, does its work quickly, and leaves the floor in good condition for shovelling. It is an excellent machine when the conditions are favorable for its use, but it has disadvantages that militate against its general adoption. First of these is its weight. This makes it impracticable for use in thin or small seams. As it is evident that the quicker a machine can be moved from room to room the more work it will do, there should not be less than 3½ to 4 feet of height of coal, so as to enable easy handling of machines of this type. A good roof is also essential to successful work with this machine. It is held up to its work by a screw-jack that bears against the roof, which if not solid is apt to be jarred down. The props must be kept at a distance of 10 feet from the face, unless they are moved as the machine advances

across the room. To move them takes time and additional labor, which adds to the cost. These same objections apply to machines of rotary action. If iron pyrites or sulphur balls are present in that portion of the seam cut out by machine, the wear and tear on the machine is increased and breakage will frequently occur.

Mr. Gould stated that notwithstanding these objections he had seen a Jeffrey machine run by two men, a runner and a helper, keep up an average of 45 tons per day, in a mine where the roof was very bad.

Another mining machine is that known as the "Ednie," which is the property of the General Electric Company, of Schenectady, N. Y. In the opinion of many coal men the principle on which this machine works is destined to become the favorite. The cutting is done by a series of rotary drills, so arranged as to cut close to the side. The advantages claimed for this machine are that it requires less power than other types, and, having fewer parts, is less liable to breakage. From what he had seen of this machine, he doubted if it will ever displace hand mining unless it is greatly improved. Owing to the ridges left between the cuttings of the drills, it makes a very uneven floor. In fact, as far as he knew, he said, this machine never accomplished any successful results.

Mr. Gould also stated that there were several other types of electric mining machines in operation in different parts of the country, but as yet data regarding their work was unobtainable.

He outlined the requirements of a successful mining machine as follows: It should be light and low in height, should have few working parts and be free as possible from complicated construction. It should be small enough to be easily transported from place to place in the mines.

With a successful machine built on these lines the harder and more disagreeable part of coal mining would disappear, outputs would be increased and dangers lessened.

An examination of the reports of the Inspectors of Mines of Pennsylvania, for the past three years, will show that during that time there were 56 fatal and 63 non-fatal accidents that occurred while the victims were undercutting the coal. With mining machines the liability of personal accidents of this kind is removed. Mr. Gould holds that the use of electricity as a means of transmitting power in mines has passed the experimental stage, and its practicability, efficiency and economy are proven by the large number of electrical plants put in at mines and used for various purposes.

While it is often a difficult and expensive matter to convey steam or compressed air to the point in the mine where it is to be utilized, the transmission of an electric current to the same points is easily and cheaply accomplished. Connections and disconnections can be quickly and readily made, but with steam or air pipes the case is different. Again, it is practical to carry electric wires through passages which would not be suitable for steam or air pipes. It is true that there have been electric plants that proved failures, but this was not due to the power, it was due to the construction of the plant. In these days of close competition the question of undercutting coal by electricity is an important one that should be carefully studied by all those engaged in mining.

The success of any plant will depend largely on the management of the mine and the methods employed therein. Mr. Gould states that he found the best results were obtained when the rooms were cut in regular order, and when the roof was strong enough to permit of comparatively wide breasts, as this will save time in moving the machine.

He further stated that neither of the machines he mentioned required a current of over 230 volts, an intensity that is perfectly safe to life and property.

In conclusion Mr. Gould offered comparative statements of the cost of machine mining, the first of which was based on the report of the Commissioner of Labor Statistics of the State of Ohio. This statement showed that in 1892 there were 1,788,645 tons of coal of all kinds mined by machine in that State. The average costs per ton were as follows:

Average price paid for cutting per ton	$0.081
Average price paid for drilling and loading	0.3747
Average cost of repairs to machinery per ton	0.0137½
Average interest on capital invested per ton	0.01445
Average cost extra men per ton	0.00815
Total cost per ton	$0.4920½

Or 49½ cents per ton, as against 70 cents per ton, the average price paid for pick mining. This shows a saving of 20½ cents per ton.

At the Cannelton mines, of which Mr. Gould is foreman, owing to the seam being thin the cost of machine mining was higher, as shown below:

Cost of cutting per ton	$0.15
Cost of drilling and mining per ton	0.35
Cost of repairing machinery per ton	0.02
Interest on capital invested per ton	0.02
Total cost per ton	$0.54

Pick mining costs 65 cents per ton, showing a saving of 11 cents per ton by machine mining.

Klonne's Improvements in Gasholders

On January 30, U. S. Letters Patent (No. 513,514) were granted to Mr. August Klonne, of Dortmund, Germany, for "certain new and useful improvements in gasholders." Using the words of the specification:

This invention applies to holders for manufactured or natural gas and relates particularly to the guides on the holders and their arrangement relatively to the posts or supports on which said guides run as the holder rises and falls in operation.

The object of the invention is to so construct the guides and arrange them relatively with the posts and their bracings as shall prevent wind pressure on the gasholder from exerting injurious lateral strains on the posts or holder.

The invention consists in an arrangement of the holder rollers with or in such relations to their post guides and the bracings which connect the posts, that lateral strains will be communicated in a line substantially parallel with the planes of the bracings which form polygonal sides of the holder frame, and whereby lateral strains on the holder will be largely taken up by or in these bracings and whereby at the same time the strains will be distributed to a maximum number of posts and bracings, thus relieving from excessive pressure or strains those parts directly in the line of the lateral strains and promoting the durability of the whole apparatus.

The invention also comprises means and mechanism whereby the holder rollers may be nicely adjusted to the post guides so as to work with minimum play and friction and thereby promote the easy operation and maximum stability of the holder.

Reference is to be had to the accompanying drawings forming part of this specification, and in which similar letters and figures of reference indicate like parts in the several views.

Figure 1 is a diagrammatic plan view of a gasholder with posts, frame and guide rollers arranged in accordance with the invention. Figs. 2 and 3 are like views representing modifications of the invention, and Figs. 4 and 5 are detail sectional plan views drawn to a larger scale and showing preferred adjustable arrangements of the guide rollers relatively to the forms of posts shown in Figs. 1 and 2.

The gasholder or gasometer tank *A*, which may have any approved construction, is provided with a series of pairs of rollers *a*, *a* (six pairs being shown), running on six posts *b*, which are connected by braces *c*, composed of latticed bars or metal frames of any suitable construction, the braces *c*, shown in Fig. 3, being formed of crossed or duplex bars.

The holder posts may have various cross sections. Those shown in Fig. 1 and represented more correctly or to working scale in Fig. 4, are formed of two metal beams or plates having opposite edge flanges projecting in opposite directions, and bolted at their outer flanges to the bracing *c* and at their inner parts to an interior angle iron. The spaces or corners next the inner flaring flanges b^1, b^1 of the plates form ways along which the rounded peripheries of a pair of rollers *a*, *a* travel, and with which they interlock laterally as the holder *A* moves upward or downward. The posts *b*, indicated in Fig. 2 and shown more clearly to scale in Fig. 5 of the drawings, are made of two opposing channel beams or irons, set flanges outward and bolted to outer and inner face plates, and the peripherally grooved rollers *a*, *a* in this instance run along the inner flanges and plate at b^2 b^2, and interlock laterally therewith as the gasometer *A* rises and falls. In Fig. 3 of the drawings the pairs of rollers *a*, *a* have rounded peripheries which ride on the right angularly disposed inner faces or parts of the supporting posts *b*. The rollers *a* in Fig. 3 are arranged in planes parallel to or with the braces *c* at the same sides of the posts, while the rollers in the other figures of the drawings approximate more or less these parallel positions relatively with the braces *c*, or approach parallelism therewith closely enough to have substantially similar effect in transmitting lateral wind pressure strains on the gasometer *A* to the polygonal side braces *c*. These braces take up the strains in their facial planes, and thus do not have tendency to bulge laterally, while they, at the same time and in view of the peculiar relations of the guide rollers *a*, *a* with them, do not exert harmful outward bulging strains on the posts. Such harmful strains are exerted by

ordinary guide rollers arranged radially on the gasometer tank and bearing directly on the inner faces or parts of the posts, and whether each of said radial rollers be supplemented by two other rollers working along opposite side faces of the posts or whether such supplemental rollers be not used. The ordinary radial rollers, when used with supplemental side rollers above named, are usually mounted all three upon one U-shaped frame fastened to the gasholder. The aforesaid radial rollers, either alone or when used with two supplemental side rollers in groups of three rollers at each post, do not relieve the posts and polygonal side bracings from injurious bulging strains, which are greatly relieved if not wholly prevented by my plan of placing the guide rollers parallel, or as nearly as practicable in like planes with the planes of the polygonal side bracings *c* of the holder or gasometer frame.

Fig. 1.

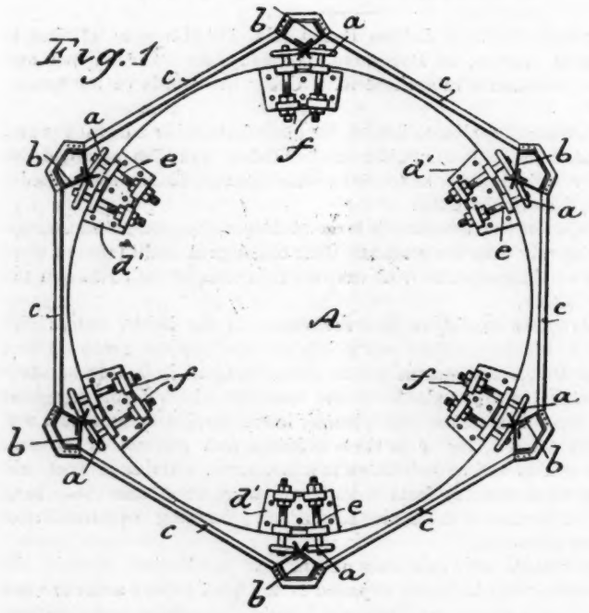


Fig. 2.

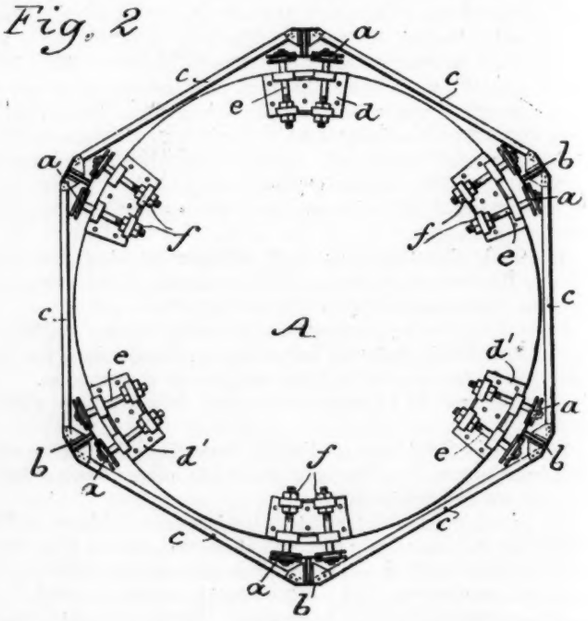


Fig. 3.

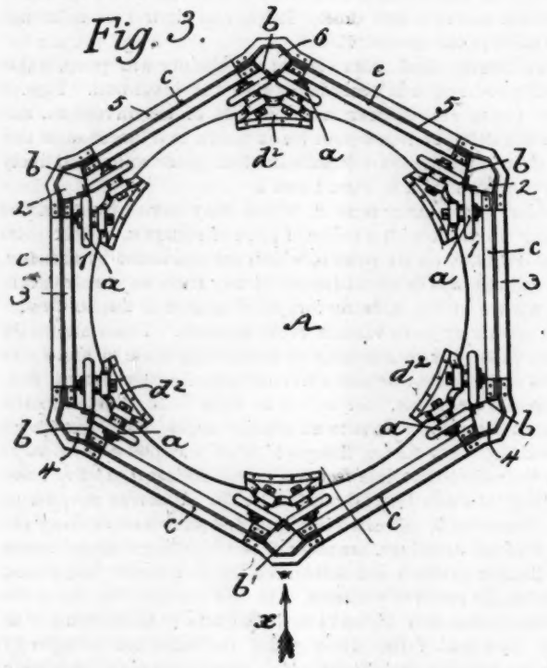


Fig. 4.

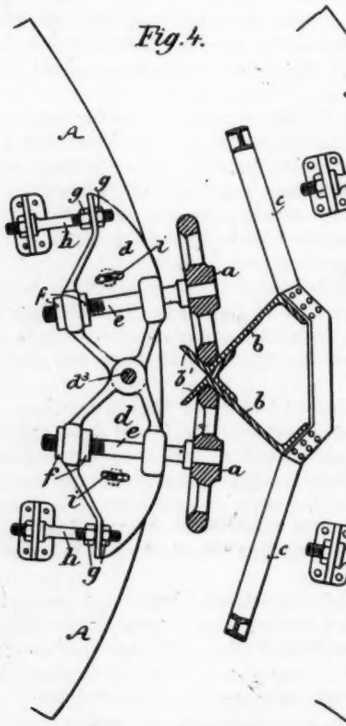
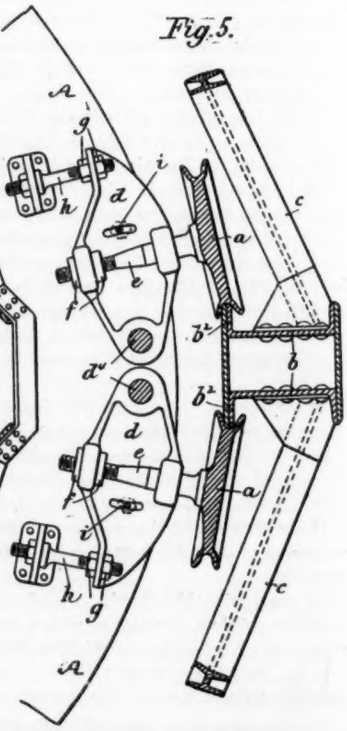


Fig. 5.



Referring to Fig. 3 of the drawings, it will be seen that a wind blowing in direction of the arrow *x* will by pressure on the gasometer *A* cause the rollers *a*, marked 1, by bearing on the two posts *b*, marked 2, to distribute the strain to the braces *c*, marked 3, which will also exert a drawing action on the two posts *b*, marked 4; thus widely distributing the strains from the wind pressure upon most of the posts and braces of the structure, and imparting comparatively little of said strains through the farther braces 5 to the posts 6 opposite and in line with the wind pressure.

By adopting the construction shown in Figs. 1 to 5 inclusive, or by a forked or interlocking construction or arrangement of the posts and rollers, a lateral strain from any side on the gasometer *A* will be communicated to all or nearly all the posts and braces of the structure. This effect, while resulting in some degree from the interlocking of the rollers and post flanges alone, is materially aided by the mutually helpful arrangement of the rollers as nearly as may be in parallel planes with the polygonal side braces *c* of the structure. In addition to such parallel and interlocking arrangement of the rollers above named, I prefer to make the rollers at each post independently adjustable thereon.

In Figs. 1 and 2 of the drawings, each roller *a* is journaled on a shaft *e*, which is screw threaded at its inner part, and the two shafts of each pair of rollers are fitted in lugs of plates d^1 bolted to the top of the gasometer. Nuts *f f* on the threaded end of each roller shaft *e* permit endwise or radial adjustment of the shaft to properly adjust the interlocking roller relatively with the adjacent post flange b^1 or b^2 on which it runs. In Fig. 3 the guide rollers are held non-adjustably to bearings d^2 fixed to the gasometer.

Figs. 4 and 5 of the drawings illustrate how the guide rollers are arranged for both radial and tangential adjustment by pivoting the bearing plates d, d, in which the roller shafts e, e are held to the gasometer, both bearing plates on one shaft or pin d^3, as in Fig. 4, or each plate on its own pivot pin d^4, as shown in Fig. 5. The roller shafts e are adjustable endwise or radially and are secured by nuts f thereon. At their free outer ends the bearing plates d fit loosely over or upon screw-threaded shafts h, held to the gasometer and having locking nuts g, which secure the plates at any position to which they may be adjusted horizontally by rocking them on their pivots. Bolts i held to the gasometer and passing through segmental slots of the bearing plates and having nuts (shown in dotted lines) above the plates, assist the detents h, g in securing the adjusted plates. The detents h or i may alone be used as desired.

It is obvious that with the duplex adjustment above described, the guide rollers a, a may independently be fitted with accuracy to the flange tracks of the holder posts to assure the best or most equable distribution of lateral strains upon the gasometer A to or through all the polygonal side braces c and posts b, while assuring the most smooth or easy travel of the guide rollers on the posts during operation of the apparatus.

Cost of Nova Scotia Coal.

Mr. Darius H. Ingraham, U. S. Consul-General for this country at Halifax, N. S., at the request of the State Department recently transmitted the following report respecting the cost of Nova Scotia coal:

In compliance with the request of the Department I inclose a statement covering the cost of mining coal in Nova Scotia and of shipping it to the United States, prepared by Mr. M. R. Morrow, of Halifax, who is considered the highest authority.

Cape Breton coal, at mines' ports, which are all within 25 miles of the respective mines—

Screened	per ton,	$2 50
Run of mine	"	1 80
Slack	"	1 10

These are subject to a discount of 5 cents per ton for 1,000 tons and over, 10 cents per ton for 5,000 tons and over, and 15 cents per ton for 10,000 tons and over.

Pictou coal, shipped at Pictou, about 15 miles from the mines—

Screened Acadia	per ton,	$2 50
Run-of-mine Acadia	"	2 25
Slack Acadia	"	1 50
Culm	"	80
Screened Drummond	"	2 25
Run-of-mine Drummond	"	2 00
Slack Drummond	"	1 50
Culm Drummond	"	80

Pictou is closed to navigation for five months of the year, when the coal must be shipped from Halifax, 100 miles distant, at an additional cost over Pictou of 80 cents per ton.

Spring Hill coal, at Parrsboro', 27 miles distant from the mines—

Screened	per ton,	$2 75
Run of-mine	"	2 50
Slack	"	1 40
Culm	"	1 00

The estimated cost in 1893 of mining and shipping the various coals of the province, free on board vessels at the mines' ports, for run-of-mine coal, was—

Cape Breton coal	per ton,	$1 40
Pictou coal—Acadia mine	"	2 00
" " Drummond mine	"	1 85
Spring Hill coal	"	2 15

Prices paid miners at Cape Breton mines per ton were as follows—

Gowrie	46 cents.
Little Glace Bay	42 "
International	44 "
Old Bridgeport	44 "
Reserve	42 "
Emery	43 "
Gardener	55 "

Coal freights from Nova Scotia to New England during the last five years averaged $1.90 per ton on the small quantity sent there, which was mostly in sailing vessels. The above prices and rates are for the ton of 2,240 pounds.

Wind Pressure.

Prof. Kernot, at a meeting of the Australian Association for the Advancement of Science, submitted a paper on "Wind Pressure," which has attracted considerable attention in the engineering world. The Professor, who occupies the Chair of Engineering in the Melbourne University, noted the inconsistencies appearing in engineering and architectural practice, with regard to wind bracing of chimneys, roofs, bridges, etc., and to the great variation in the anemometric results given by the meteorological observatories; some observatories, such as Bidstone, near Liverpool (England), and Sydney, recording pressures, or velocities corresponding to pressures, of 90 pounds or 100 pounds per square foot, while others, such as Greenwich and Edinburgh, Melbourne and Adelaide, give results only one third as great; and it was pointed out that these latter results correspond fairly well with the usual experience with railway carriages and chimneys, great numbers of which would overturn with pressures of not more than 30 pounds per square foot, and yet as a matter of fact do not overturn, and are regarded by the public as perfectly safe. Reference was next made to the experiments tried by Sir B. Baker at the Forth bridge, which showed that the average pressure on surfaces as large as railway carriages, houses, or bridges, never exceeded two thirds of that upon small surfaces of 1 or 2 square feet, such as have been used at observatories, and also that an inertia effect which is frequently overlooked may cause some forms of anemometer to give false results enormously exceeding the correct indication.

The very elaborate experiments of Mr. O. T. Crosby, detailed in *Engineering* of June 13, 1890, were next dealt with. These experiments showed that the pressure varied directly as the velocity, whereas all the early investigators, from the time of Smeaton onwards, made it vary as the square of the velocity. Experiments made by the author of the paper, at speeds varying from 2 to 15 miles per hour, were described, which agreed with the earlier authorities, and tended to negative Crosby's results. It was pointed out, however, that further tests on a greatly extended range of velocities were needed.

The paper next described an apparatus devised by the author for determining the relative pressure of the wind on flat plates, cubes, cylinders, spheres, and other geometrical forms. This apparatus consists of a screw propeller similar to that used on steamers, 28 inches diameter and 48 inches pitch on a 30 inch tube. This propeller is caused to revolve at speeds varying from 400 to 800 revolutions per minute by means of a gas engine. The helical currents of air proceeding from the propeller are gathered up and discharged in one approximately steady jet of 12 x 10 inch section, by means of a radial diaphragm and a conical mouthpiece, having its axis tangential to the helical direction of the air. In front of this jet was placed the object to be tested, supported upon a very delicately made carriage, running on an accurately leveled surface plate, the force exerted being measured by a delicate spring balance, the accuracy of which has been verified by means of standard weights. A large number of experiments were made with this apparatus, and many interesting and valuable facts elucidated. The ratio existing between the normal pressure on a sloping surface, such as a roof, and that upon a vertical plane was found to agree with the table given in Stoney on "Stresses," p. 524; but it was found that this result applied only to roofs supported on thin columns, under which the wind could blow freely. When the roof was placed upon a wall, as in an ordinary building, the wall deflected the current of air upwards, and greatly reduced the pressure on the roof. If the wall was provided with a parapet of ordinary proportions this effect was still more marked, the pressure being reduced to one third of what it would otherwise have been. In the case of a roof of 30 degrees pitch the pressure was actually reversed, the roof having a slight tendency to lift. In these experiments the parapet was made only one sixth the height of the roof, measured from the level of the eaves to the ridge.

Experiments were also made as to the effect of a wind blowing in at the open end of a building having the sides and other end completely closed, and it was found that the internal pressure tending to lift the roof was equal to the pressure of the wind on a flat vertical surface. The pressure upon one side of a cube, or of a block proportioned like an ordinary carriage, was found to be .9 of that upon a thin plate of the same area. The same result was obtained for a square tower. If the cube or tower was placed so that the wind blew in the direction of a diagonal, the total pressure was just the same as when one side was presented.

A square pyramid whose height was three times its base, and which represented a common form of church spire, experienced .8 of the pressure upon a thin plate equal to one of its sides, but if an angle was

turned to the wind the pressure was increased by fully 20 per cent., a curious contrast to the action on a cube or square tower.

A bridge consisting of two plate girders connected by a deck at the top was found to experience .9 of the pressure on a thin plate equal in size to one girder, when the distance between the girders was equal to their depth, and this was increased by one-fifth when the distance between the girders was double the depth.

A lattice work in which the area of the openings was 55 per cent. of the whole area, experienced a pressure of 80 per cent. of that upon a plate of the same area. The pressure upon cylinders and cones was proved to be equal to half that upon the diametral planes, and that upon an octagonal prism to be 20 per cent. greater than upon the circumscribing cylinder. A sphere was subject to a pressure of .36 of that upon a thin circular plate of equal diameter. A hemispherical cup gave the same result as the sphere; when its convexity was turned to the wind the pressure was 1.15 of that on a flat plate of equal diameter.

When a plain surface parallel to the direction of the wind was brought nearly into contact with a cylinder or sphere, the pressure on the latter bodies was augmented by about 20 per cent., owing to the lateral escape of the air being checked. Thus it is possible for the security of a tower or chimney to be impaired by the erection of a building nearly touching it on one side.

A number of interesting experiments were made upon the shelter which one surface affords to another. This shelter was found to extend in front to a distance about equal to the breadth of the sheltering surface, and behind to several times that distance. For example, a 9-inch disk being used as the sheltering surface, and a 6-inch disk being placed 2 inches in front of it, the latter received only two-thirds of the pressure it endured if the larger disk was removed, and this reduction in pressure was perceptible, though to a less extent, at all distances up to 9 inches. Behind flat surfaces eddies were found to exist, which caused other surfaces placed behind to be urged forward with considerable force. For example, a 7-inch disk placed behind a 6 inch disk, and 4 inches from it, was urged forward with one-fifth of the pressure with which it was urged backward when the 9-inch disk was removed.

In conclusion, it was recommended that 20 pounds per square foot be taken as the maximum wind pressure upon areas of not less than 300 square feet, and 30 pounds for smaller areas in positions of full exposure in the southern and southeastern parts of Australia; that in more or less sheltered positions these values might be reduced according to judgment, the minimum for extremely sheltered positions being taken as one-half the above figures; that the pressure on chimneys, towers, spires, roofs and other objects be deduced from those on thin plates of equal area by means of the results previously given; and that a factor of safety of 2 for cases of simple stability, and 3 where the question is one of strength, should be employed.

The Wellston Coal District in Ohio.

[By Prof. J. A. Ede, before the Ohio Institute of Mining Engineers.]

The Wellston coal field, we will find by examination, presents some structural features worthy of consideration. To-day a tract of the Wellston coal is considered valuable property. It has changed hands recently for $250 per acre. How much of this coal is still left is a matter many of our operators would like to determine. In the map the first mine is the Tom Corwin No. 2. The coal here was cut at about a depth of 45 feet; the main entry starts about north from the shaft. It was intended to have driven this entry into the center of the property; but within about 200 feet of the shaft the bottom began to raise rapidly until it reached 30 feet above the level of the bottom of the shaft. It was then suspended in the hope that the hill would cut off, east or west, by the butt entries. In the western entry a small swale was followed for some time, but there was not much gained by it, as the hill was cut again. On the summit of the hill the roof is broken and the coal only about 6 inches in thickness, more or less. From the top of this hill they sunk on the other side. When I last saw the coal it had almost reached its normal thickness. If a series of holes had been sunk from the surface on the side of this underground elevation it would tend to indicate that the margin of the coal had been found at this place. Such, however, is not the case, as other holes on the property, and the work on the north side of the hill conclusively demonstrate.

The ridge and furrow condition is to a more or less extent a common feature in the mines contiguous to the line of the field shown on the geological survey, and on the map, and is a part of the structural arrangement I desire to outline. Adjoining Corwin No. 2 is Superior No. 3, one of the most successful mines of the district. I believe they have hoisted more coal out of this mine in one day than from any other in the district. Here, however, may be seen the same structural condition as at Corwin No. 2, but in this place the hill was penetrated, an opening secured, and afterward every advantage taken of the conditions to open the mine. They keep a permanent engineer, have the mine posted up closely, so that the foreman has a good conception of the irregularities of his ground, and is thus enabled to determine his *modus operandi*. Between Superior No. 3 and Glen Nell a number of holes have been drilled. In some of these coal was struck; in others it was absent. The drilling indicated something of the condition of things noticeable at Corwin and Superior mines. It is not at all improbable that when this ground is approached by the workings of the adjoining mines some good patches of coal will be found, and still north some mines opened out.

Glen Nell was opened out by Mr. Jerry Morrow, one of the pioneers of this coal field. The same features are observed here. In driving one of the entries the coal commenced to rise rapidly, as observed in the other mines. The difference of elevation here and at Buckeye, an adjoining mine, gave some the impression that this was the No. 1 seam of coal. This difference, however, is being rapidly diminished through the upheaving of the coal showing the structural arrangement referred to. North of this mine on the Richmond property there is a good crop of coal in a disturbed stratification. Between Glen Nell and Superior No. 3 mine there is an interesting piece of land projecting into Vinton county, whereon the Wellston coal is to be found.

Leaving here and passing to No. 6 Superior, a mine well within the old lines, and with the coal about the same as generally found, we find to the west of this, and outside the line, on section No. 36, Jackson township, and in the locality of Canter's Cave, an opening on the Wellston coal showing the same condition of things as at the places mentioned, the coal dipping rapidly in a small opening made in the hill. Coming around on the south side of the field we note the Indiana, Cameron and Corwin No. 1 over the line. I am not aware of there being in any of these mines indications of a disturbance of the nature we have referred to. These mines on the borders show some slate in the coal, and in proximity to the line indicated. Superior No. 4, in the south part of the mine, does not produce coal equal to that produced in the north, but it is workable and marketable coal. Holes have been drilled on the southeast quarter of section No. 1, showing some coal, but on section No. 12 the result was not as satiafactory. Some of the holes showed coal, others none. The coal in Fluhart No. 2 for a portion near the boundary shows more bone but no marked disturbance. After leaving here we again meet the same phenomena. This is observable at Superior No. 6, Fluhart No. 3, Wainright mine, and by a series of holes on sections 31 and 32, connecting with Corwin No. 2, the place of beginning. We have now followed a peculiar structural arrangement from Fluhart No. 2 to close to Jackson. The value of this is best estimated by those whom it concerns.

I may say that, to the geologist, this line of structural arrangement of the floor of the basin of this field is interesting as far as it helps to show where the pressure and resistance occurred, how the basin was formed, and throwing some light on the local dynamic agencies instrumental in the formation of the field, and in so far as it disposes of theory for fact. To the engineer these facts are the first that should receive his attention. They are as important to him as is the kind of roof or floor he has in his mine. Instances can be given where hundreds of dollars a month in dead cost is the result of the want of a proper consideration of these facts.

I claimed that the Wellston coal extended beyond the old limits. If the map is a fair representation of the field, as laid down in the geological survey, there can be nó question on this head. Corwin No. 2, Superior No. 3, Glen Nell, Buckeye, and part of Indiana, Corwin No. 1, Fluhart No. 2, and the whole of Wainright mine are working to day outside the old limits. Also to the north on Richland and elsewhere in Vinton and Jackson townships this coal has been found and drilled upon in different places. To the east of Wainright mine, on the Long and Fitzpatric land, four holes have been drilled, in all of which the Wellston coal was found in good thickness, and there is no question but that the field extends here and further. Of the presence of this coal we have very satisfactory evidence. Still further east the Wellston coal has been found by drilling. This would represent in length an extent equal to the original field, and in the near future I have no doubt that many mines will be opened east and north of the present limits.

Summarizing the contents of this paper, and what is shown by the map, I submit that from the study of this field we learn, first, that contiguous to the line of the old survey, from Fluhart No. 2 to Jackson, there is a structural peculiarity common to the mines worked in that locality; second, that the development of the mines in the neighbor

hood of this line must be governed by this structural characteristic; third, that the fact of finding no coal in some of the holes drilled does not always show the margin of the field; fourth, that the Wellston coal field is not exhausted, but that there is much of it undeveloped, that it extends to the east and north, and, possibly in other directions.

Beams and Floors of Concrete.

Building News says that as the strength of concrete is much less in resisting tensile than it is in compressive stress, its employment for beams has not met with much success. It is true, indeed, that for floors, lintels, staircases, concrete has been used with considerable advantage, as being conveniently handled and placed *in situ*, yet there exists the disadvantage of not being able to test its strength transversely with any degree of reliability. The data furnished by authorities are not generally satisfactory; the proportions of cement and aggregate differences of age and other conditions are varying in the tests given. The proportion of sand is a material factor: the greater the quantity the weaker the result. It is obvious, moreover, that to obtain an approximate estimate of the transverse strength of beams made of concrete, a series of experiments, including a variety of aggregates and ages, would have to be made. One fact is pretty clearly established, and that is that the transverse strength of good concrete is quite equal to, if not greater than, natural stone. To take a few of the tests made with concrete beams supported at the ends: Kirkaldy gives for a beam of 1 of Portland cement and 1 of coke breeze, 7 days old, 3 inches broad, 5 inches deep and 72 inches clear span, loaded at center, an average breaking weight of 3.85 hundredweight, allowing one-half weight of beam between supports 0.22 hundredweight, or a total central load of 4 07 hundredweight; with an aggregate of 2 crushed bricks, 2 or 3 months old, a beam 12 inches by 8 inches deep and 60 inches span, gave in center an average breaking weight of 13.25 hundredweight, and a total center load of 15.08 hundredweight. Another result of a beam of 1 of cement to 0.6 of gravel, 90 days old, 12 inches by 12 inches, 36 inches span gave an average breaking weight of 46.67 hundredweight on central 6 inches. These are taken at random from a table in Mr. E. L. Sutcliffe's useful book on "Concrete" we lately noticed; but they differ so much in composition, age and scantling that no reliable result can be obtained. It is evident that the addition of sand very considerably reduces the transverse strength, the beam made of neat Portland cement being three times stronger than one of 1 of cement to 2 of coarse sand, the average breaking weights being given as 57.80 hundredweight for the neat specimen and 18.30 for the one with sand.

But we have little confidence in tables of tests, though we gather from them the general fact that good concrete is quite equal, if not superior, to many natural stones for beams, lintels, flooring slabs and other purposes in which transverse strength is necessary. When the ends of concrete beams or slabs are fixed or "pinned" into the wall or built upon, considerably more strength is gained than when they simply rest on the walls. Mr. C. Colson's tests of two beams of concrete 9 feet long, 21 inches wide and 9 inches deep, are instructive in this connection. He placed one of these beams simply resting on supports. At the end of 14 days the scaffolding below was carefully removed, when the beam at once broke with its own weight; the other beam was prevented from spreading by counterforts at the ends, and showed no sign of weakness. After remaining unsupported for 16 days longer, a weight of a quarter of a ton in the center produced a faint crack; with 0.635 ton the crack increased to half the depth. The load was increased to 1.292 tons, when the beam gave way. The experiment at least shows the advantage of preventing spreading or lateral movement. In point of fact, the beam with its ends backed up becomes practically a flat arch, as the crack only appeared on the upper half of the beam, the lower segment of the mass adding nothing to its strength. The same experimenter found by other similar tests that confining the ends of the beam increased its strength nearly three times, and he also proved that the flat segmental arches of concrete had great strength. Whatever the value of these experiments may be, they at least establish the assumption that a beam of concrete with its ends securely supported or confined becomes a flat arch, the resistance of the material being mainly compressive and confined to the upper half of the section, within a curve or segmental line from this point of the center to the beds of the beam. In other words, we may imagine a segment struck within the thickness of the lower half or depth of the beam, all below which curve may be cut away. We have a notable example of this fact in the concrete arched floors which spring from the bottom flanges of girders, of which we have instances in Dennett and Ingle's fireproof floors and in those of Homan and Rogers. When all the four edges of a concrete slab are fixed into walls, as in the case of stair landings and floors, the increase of strength is more than double that in which only two ends are fixed.

It is clear from these experiments that if we can incorporate into the body or mass of the beam or slab iron ties in the lower half of the concrete, we shall greatly add to the strength. Some years ago we remember seeing some beams and floors at Stoke Newington which the late Mr. Allen had introduced, in dwellings let out in flats, in which floors iron tie rods were imbedded. Mr. Hyatt, whose treatise we noticed some years ago, inserts iron ties or tension plates in the lower section of his concrete beams, which materially adds to their strength, and the idea of inserting iron rods in the lower half of beams and slabs to assist in the tensile resistance has been greatly developed in several ways. Blocks, soffits, beams, cupolas, and entablatures of concrete, with iron bars introduced, were largely used in the S. K. Art and Science Schools, the details of which are illustrated. One of the first objects was to prevent the rod slipping or drawing through the concrete; but experiments have proved that the iron bars under a considerable strain on the beam preserve their hold when they are left with their natural surface. The use of twisted rods gives a better grip. It has been found that the most advantageous position for the iron tension rod is near the bottom of the beam, and that the ratio of iron rods to the concrete (coke breeze) should not be less than 1 in 20. The tension rods or plates should be so proportioned and at such a distance from the neutral axis of the beam that the compressive resistance of the concrete of the upper half of beam shall not be greater than the tensile resistance of the iron rods. The ratios between these two resistances of concrete vary according to the cement and aggregate used, so that we can only ascertain the sectional area of iron rods required when we know the actual ratio subsisting in a given beam. It is safer to make the iron rods equal to the crushing strength of the concrete, neglecting the tensile resistance of the latter.

The architectural use of concrete for beams, lintels, floors, and as a substitute for stone, has already been tried. In blocks of dwellings, in flats, in which a large number of window heads, door heads, floors, and landings of one type is necessary, the value of concrete is undeniable, and a considerable saving in cost must accrue. More has yet to be accomplished in extending the material constructively. In pier building we may yet hope to see progress made, so that we should not altogether have to rely upon iron stanchions and pillars.

For beams, floors, bressumers, arches and domes, the combination of concrete and iron promises to yield results even greater than we have seen, when once the practical difficulties of manufacture have been overcome. Whether deposited *in situ* or laid in large flags, concrete has become an important material for town paving, and many manufacturers of artificial stone—like the Victoria stone, the patent artificial sandstone, the granite concrete flooring of W. B. Wilkinson & Co.—have solved the obstacles that were once apparent. For wall building and for architectural purposes the material has not yet appeared to have made much progress, owing to the advantages offered by brick and terra cotta; but for sea, river, dock and sea walls, the value of concrete blocks has long since taken the place of natural stone. For town dwellings the external facing concrete, or slab, offers several advantages, if only architects could adapt this superficial mode of treatment to their wants.

Municipalities and the Purchase of Private Undertakings.

Engineering, in the course of a most reasonable article on the increasing tendency of municipalities to *acquire* private undertakings, remarks:

With comparatively few exceptions, undertakings for the advantage of the public, involving the speculative element, are carried out with money privately or voluntarily subscribed. This is proper, for it would not be right to take ratepayers' money for schemes which did not promise success, more especially when it is impossible to differentiate between consenting and objecting ratepayers. Thus we find that in the early ages of gas and gravitation water supplies, it was left for private companies to inaugurate works, and even at the present time this principle is adopted most advantageously, even in cases of gas and water, but more particularly in respect of electric lighting and tramway schemes. In the past there was a due disposition to consider the risks run by what we might call exploiters, when the time had come for purchasing the gas or water schemes on behalf of the people. But in the advance of the democratic spirit which has become so dominant in political life by reason of the extension of the franchise, this reasonable attitude is more and more lost sight of. Now, not only may municipalities compulsorily purchase

tramways and electric generating and distributing works when they have become assured successes, after the lapse of a certain number of years, but the tendency is to pay to the originators for their plant a price equivalent, perhaps, to that for an equal weight of good scrap iron. The advisability of the former enactment may or may not be quite recognized, but there is no doubt that the latter is an unjust tendency, and many will be satisfied with the decision come to in the Queen's Bench Division this week by Mr. Justice Mathew and Mr. Justice Collins, sitting together on an appeal case between the London County Council and the London Street Tramways Company. The point involved affects the whole question of the purchase of private undertakings by municipalities; and one cannot but recognize the far-reaching effect of the decision, for while eminently just and commonsense, it is not quite the legal view taken on one or two previous occasions. The desirableness of judgment by the highest Court of Appeal is therefore evident, and the London County Council might spend their money less profitably than in ascertaining if the extreme view held by them is to be extended throughout the country by authority of the House of Lords as as appeal court.

The facts of the case are easily recited. The London County Council, in their desire to act as universal providers as well as guardians of the people's interests, determined to take advantage of the provisions of the London Street Tramways Act of 1870, whereby the four or five miles of tramway in Camden Town and Kentish Town could be purchased compulsorily at the expiry of 21 years. In conformity with the Act, Sir Frederick Bramwell was appointed arbitrator on the question of the sum to be paid. The section of the Act by which this question was to be determined is important. It stated *inter alia* that "the company shall sell to them their undertaking upon terms of paying the then value (exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale or other consideration whatsoever) of the tramway, and all lands, buildings, works, materials and plant of the company suitable to and used by them for the purposes of the undertaking, such value to be, in case of difference, determined by * * * a referee." In the course of the proceedings before Sir Frederick Bramwell, the tramway company proposed to tender evidence of the actual profits made by them from traffic on the lines to be purchased, with the object of the value of the tramways being determined by taking a certain number of years' purchase of the profits. The County Council objected, and the arbitrator, doubtless in view of the parenthetical phrase in the section quoted, determined that the Act did not authorize him to adopt a method of valuation based on a number of years' purchase of profits. Evidence was allowed to show the rental value of the tramways considered as let, or capable of being let, to a tenant; but Sir Frederick himself admits that he did not consider this evidence in arriving at the award. The value, which was put at $322,700, was really determined on the cost of construction, less depreciation. In other words, it was exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory purchase or other consideration whatever, except the consideration of the value to the tramway company or the Council, measured by what it would cost either the company or the Council to establish the tramways if they did not now exist. The tramway company appealed against the decision, contending that the arbitrator ought to have taken into consideration the evidence given on behalf of the company as to the rental value of the tramways considered as being capable of being let to a tenant, and that he was wrong in excluding evidence of the profits obtained from the traffic. Both judges have decided the appeal in favor of these contentions, the County Council being ordered to pay expenses; so that if the law is thus interpreted aright, the future basis of determining the purchasing value of undertakings to be paid by municipalities is clear, at all events until the law is changed.

The reasons for arriving at the decision are interesting, as reflecting on the need for any change, or the direction in which the change should be made, towards explicit statement of what is just. Justice Mathew, in his decision, contended that the first definition necessary was as to that which was purchased or sold. In this case it was the undertaking, which, in the third section of the Act, was defined as "the tramways and works and undertaking by this Act authorized," and not only the materials *in situ*. The consideration to be paid was "the then value of the tramway." Value, as the Judge remarked, had a well ascertained meaning, and is to be interpreted as in the Acts relative to rating, these tramways being a tenement assessable to the poor rates. This point is of great importance. Of course the chief difficulty is the words in parenthesis in the section of the Act, and which are reproduced; and this difficulty is increased by the definiteness with which past or future profits are indicated, which, it is assumed, excludes all profits. The "then value," however, are the important words, and clearly, as Mr. Justice Collins pointed out, they imply that the value is to be based on that which can be made by the use of the tramway. The arbitrator, the judges consider, adopted an interpretation which excluded this consideration. The method of arriving at the value by taking the hypothetical costs and a speculative depreciation did not recommend itself to the Court in preference to the usual modes, and the judges did not think the parenthesis such a potential and drastic enactment as the County Council sought to make it. The important words of the section are "the then value." That is to say, the mode of ascertaining the value is to take the present earnings and assume that the same will be made in the future. No addition is to be made for future increase or for past profits.

Detection and Estimation of Gas or Vapor in Air.

In a lecture before the Society of Arts, on the subject named in the heading, Professor Frank Clowes, D.Sc., said that in treating his subject he must, naturally, begin with the early methods of dealing with firedamp in coal mines. This gas is combustible, but its flame is somewhat more pale than that of coal gas. In the early days of coal mining, when the coal was near the surface, this gas gave some little trouble; it used to catch fire, and produce flares and flashes which sometimes resulted in serious burns. At first the common plan for getting rid of the gas was to burn it away, the quantity was so small. Then air was blown down into the mine to push the gas out, and later on the necessary ventilation was obtained by means of a fire at the bottom of the mine. Ultimately these methods were replaced by the present arrangment—namely, a large fan in constant revolution to exhaust the air from the pit. In all modern pits at least two shafts are driven down to the coal—one to suck air out and one to drive air in; these being respectively called the up-cast shaft and the down-cast shafts. The down-cast shaft delivers pure air into the pit, and this is subdivided into branches or "splits" throughout the mine. From the fresh surface of the coal in a mine gas is always escaping.

For the purpose of his lecture, Professor Clowes took common coal gas as a fair representative of this mine gas or firedamp. By experiments he showed that coal gas mixed with air produces an explosive mixture, and that when the proportion of air is very much increased the mixture will not burn at all. Continuing, the lecturer said the greatest necessity for delicate testing and measurement exists, not at the working face of the coal, but in the "returns" or passages through which the mixture of air and gas passes, and especially in the main "return." The test should be capable of indicating, not 3 per cent. of gas, but at least as low as 1 per cent.; and in many cases the detection of ½ and even of ¼ per cent. is desirable. The condition of a mine can be most accurately gauged by testing in the main "returns"; but it is necessary to make repeated observations, because the conditions may vary. A watch should be kept upon these "returns," and the ventilation adjusted in accordance with the results obtained. Mr. William Galloway has shown that a mixture of air and gas containing 0.8 per cent. of gas, though not explosive by itself, becomes explosive when it is mixed with a sufficient quantity of very fine coal dust. There are also other gases that ought to be estimated; for example, there are occasions when coal gas ought to be tested for. It may be said that coal gas can be smelt, but there are people who cannot smell it; and it frequently loses its odor, the soil through which it has passed depriving it of its odorous properties. In such cases it would be advantageous to test for coal gas as firedamp is tested for.

There are also inflammable vapors of liquids which may cause danger when mixed with air; one of the most prominent being the vapors from petroleum. When the tanks of the petroleum carrying ships are emptied of oil they are still filled with air charged with petroleum vapor, and it is now made compulsory to have the interiors of these tanks carefully examined before lights are taken down into them. It therefore becomes necessary to have some means of detecting these petroleum vapors, for one cannot measure their quantity by the degree of smell. As the vapor in petroleum tanks is heavy, means have to be taken to blow it out; and the actual quantity of this vapor required to produce an explosive mixture is much less than that of fire-damp. The earliest test for the detection of firedamp was by means of a naked candle; a blue cap or flame around the candle flame indicating the presence of firedamp. This is due to the fact that the dilute mixture of firedamp and air cannot maintain the temperature of combustion by itself, but requires an additional amount of heat from the candle to make it burn. Of course, this method of testing must be more or less accompanied by danger; for it cannot be known whether or not the atmosphere of the mine is explosive until the candle is brought into it.

In the Davy lamp the flame is surrounded by gauze. When this lamp is taken into an atmosphere containing firedamp the first effect is the lengthening or "spiring" of the flame, and finally, when the explosive point has been reached, a pale blue flame fills the interior of the lamp. By reducing the flame of the Davy lamp to a small blue point it may be used to test by the blue-cap method, which is the more delicate of the two. But the gauze of the Davy lamp is a much less suitable background for observing the cap than is the original black surface of the coal, and the gauze in front obstructs a great deal of the light of the cap. For these reasons it is very easy to miss seeing the cap. By surrounding the flame with a glass chimney, with the gauze chimney surmounting the glass one, more light can pass, and the cap can be more easily seen; but the reflective power of the glass at the back renders observation difficult.

This difficulty of reflection has been got rid of by roughening the inside of the glass; and still better results are obtained by smoking the roughened surface. We cannot have a better surface than the dead black produced by smoking the interior of the back of the glass; but working miners object very much to a surface that is removed in the cleaning of the lamps, and it has been found possible to very satisfactorily imitate the sooted surface by painting or burning in. In 1881 a lamp devised by two Frenchmen had the larger part of the flame cut off by means of two metal shields—one in front and one at the back—thus allowing the blue cap to be readily observed above the exposed tip of the flame. The Davy lamp, as modified by Gray and others, is now considered to give the best indications. In this lamp the feed of air is from the top, and therefore the atmosphere to be tested can be taken from the highest point of the workings, as it ought to be.

In careful experiments with this lamp—using a mixture of equal quantities of colza and petroleum, and with the flame turned down to a blue point—Professor Clowes has found that about 2½ per cent. of gas is the least that can be observed by the blue cap method. But by this method we never can be certain that we are obtaining the correct percentages, because varying quantities of gas may give different heights of cap; and this difficulty cannot be overcome so long as oil wicks are used. In Prussia a sponge soaked in benzoline has been used, and with this 1 per cent. of gas has been observed, and even as low as ½ per cent. has been seen. The benzoline flame is also a good one to see "spiring" by. "Spiring" is due to the search for the oxygen necessary to support combustion. But "spiring" may be produced by other causes besides the reduction of oxygen by the presence of firedamp. If air is heated it expands, and therefore a given volume of it will contain less oxygen; consequently "spiring" may be due to simple increase of temperature. It may also be due to the presence of carbonic acid; the wick frequently undergoes alteration with a like result; and even the motion of the lamp itself will start "spiring." Also the indications given by "spiring" depend upon whether the flame has been originally adjusted in a pure atmosphere or not. If the atmosphere in which the flame has been set is not pure, "spiring" will only indicate that there is more gas in the atmosphere into which the lamp is taken. The test will be only relative, not absolute. Consequently it is generally felt that the "spiring" test must be looked upon as only a rough one. About 2 per cent of gas is the least that can be detected by it with any certainty.

Since the time when the Government began to insist upon the inspection of mines great improvements have taken place. Between 1850 and 1880 the average annual number of deaths due to firedamp explosions was 246; between 1880 and 1888 the number was 153; and between 1888 and 1892 it was 130; and this reduction has taken place despite a very considerable increase in the number of mines. The reduction in the number of explosions is also remarkable. In five-year periods, beginning with 1851 and ending with 1890, the number of explosions and the average number of deaths per explosion were as follow:

Period.	Explosions.	Deaths per Explosion.
1851–55	464	2.5
1856–60	356	3.6
1861–65	290	2.9
1866–70	275	5.6
1871–75	243	4.0
1876–80	162	10.4
1881–85	146	6.2
1886–90	99	7.6

This reduction, Professor Clowes thinks, is not wholly due to Government inspection, but very largely to the greater care of the managers, and possibly also of the subordinate officials and the workmen. Still there remains a mortality which he cannot help feeling may be very largely reduced by more systematic methods of testing for gas. From what he has seen he concludes that the method of testing is extremely rough and casual, and he hopes that by the introduction of more delicate tests the mortality may be still very much reduced.

The lecture was illustrated by experiments, diagrams and lantern slides, some of the latter having been taken in the mines by the aid of the magnesium light.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

In our last issue we mentioned the incorporation of the American Gas Engine Company, and in mentioning the incorporators we unwittingly omitted the name of the man who more than any other is responsible for the creation of the enterprise. We allude to Mr. William Wallace Goodwin, who, besides being a Director, has also been chosen President of the Company. The American Gas Engine Company was chartered under the corporate laws of the State of New Jersey, for the purpose of manufacturing double-acting and tandem gas engines under the several patents of Griffin, Dick, Kerr & Co, of Kilmarnock and London, England. The sizes to be put on the market will range from the smallest to those of 1,000 horse power. The principal office of the Company will be located at 1016 Filbert street, Philadelphia, Pa., which is also the office of the Goodwin Meter Company. The latter will act as the Eastern Agents for the American Gas Engine Company. The officers of the Company are: President, W. W. Goodwin; Vice-President, O. N. Guildlin; Treasurer, O. N. Guildlin; Secretary, Harry B. Goodwin; Assistant Secretary, C. F. Lloyd.

The New Jersey Gas and Construction Company, of this city, has been granted a franchise by the Mayor and Common Council of South Amboy, N. J., for the operation of a gas works in that city. We do not know the conditions of the agreement, but the place does not seem to us to be a good field for such an enterprise.

The Automatic Gas and Water Stop Company has been incorporated in Baltimore by Messrs. T. M. Dukehart, R. Tyler, S. Drey, E. Rohr and M. F. Grauer. It is capitalized in $24,000.

At an auction sale in Philadelphia on the 8th inst., the following gas securities were disposed of; $350 scrip, 6's, Central Gas Light Company, New York city, at 81; 20 shares Metropolitan Gas Light Company, Brooklyn, N.Y., at 132½; 14 shares West Chester County Gas Light Company, New York, at 50; 63 shares Equitable Gas Light Company, Memphis, Tenn., at 58; 1 share Central Gas Light Company, New York city, at 50.

In further mention of the decision rendered by Judge Stubbs, of Indianapolis, Ind., in the case of Curry vs. the Indianapolis Gas Company, we may say: The affidavit charged that the Indianapolis Gas Company collected from Thaddeus Curry the sum of $2 a month for natural gas burned in a No. 7 cook stove, contrary to a section in the natural gas ordinance, and by virtue of which the defendant is doing business in Indianapolis. It was agreed that Curry, the complaining witness, had no heat for his premises, which consisted of two rooms in a tenement block, except from the cook stove, and the defendant contended that Section 2 permitted it to charge the schedule rate of $1.25 per month, from October 1 to May 1, for stoves of that character, when used for the purpose of cooking only, but that if the consumer used his stove for heating purposes he must pay something additional. It being admitted that the defendant had accepted the ordinance, there was no question of validity, and the Court thought that the only matter to be determined was under a fair construction of the terms of the ordinance, what rate could be charged for the stove mentioned in the complaint. The Court held that if the first schedule meant that cooking stoves could be used for cooking only, as contended, then it must follow that consumers are not authorized to heat their kitchens, and the defendant could require a heater to be placed alongside the cooking stove or range for the purpose of heating the kitchen when the same was not in use for cooking purposes. If the contention of the counsel for the defendant should prevail, others furnishing gas under this ordinance would have a right to ask their consumers, under a contract allowing them to use gas in cooking stoves and ranges, to turn out their fires as soon as their cooking was done. Under the construction contended for such a request would not be an unreasonable one. Nowhere in the ordinance could the Court find any reference to the amount of space which may be heated by a stove or furnace of any given size or capacity, and the Court thought that if the construction contended for be a correct one, "then the schedule would be of little value, for under it no one could tell what charge could be made for cooking stoves or ranges when it was shown

that advantage might be taken of the heat from such stove or range." In the opinion of the Court the section containing the schedule nowhere provides that cooking stoves or ranges shall be used for cooking purposes only. In holding that $1.25 per month was the maximum price for a No. 7 cooking stove, from October 1 to May 1, Judge Stubbs believed that he was supported by the provisions of the ordinance itself. In conclusion, he said: "It will be observed that the monthly charges for heating residences and offices are all made larger for the winter than for the summer months, and that the same is also true of the prices fixed for cooking stoves and ranges. That this was done for any other purpose than to provide compensation for the extra amount of gas that should be consumed for heating, is difficult to conceive. If the cooking stove can be used for the purpose of cooking only, should the same family pay more for the privilege of cooking in winter than in summer? And it also seems to me that if the charges to be made to consumers were to be based upon the quantity of gas consumed rather than upon the size of the stove in which it was to be consumed, the framers of this ordinance would have made a difference in the charge to be made for a family of two using a No. 7 or other size of stove, and a family of 10 or twelve using a stove of the same size. I do not see how the terms of this ordinance can be interpreted to mean something which is nowhere contained in the ordinance."

Mr. W. S. Bowen, who has acted as Superintendent of the Lebanon (Pa.) Gas Company since April, 1893, has handed in his resignation, the same to take effect on March 1st. He has accepted the position of Constructing Engineer to the National Heat and Power Company, of Philadelphia, a berth that he will assuredly fill with credit to himself and satisfaction to his employers.

The United Gas Improvement Company has entered into a contract with the proprietors of the Hanover (Pa.) Company for the remodelling of their works, which will be altered for the manufacture of water gas. The plant bargained for is the well known form which the U. G. I. Company recommends for small plants, of the improved Lowe type. Besides the water gas apparatus proper, the contractors will place a boiler, engine and auxiliary machinery, together with a relief holder storage oil tank. The capacity of the plant is put at 75,000 cubic feet per day, and its construction will go on at once. There was sharp competition amongst the builders of this class of apparatus for the contract.

Mr. Robert Waddell, Superintendent of the Clifton Springs (N.Y.) gas works, writes that the Sutherland system of gas making recently introduced at "the Springs" is giving excellent satisfaction. All the coal used per 1,000 cubic feet of gas does not exceed 50 lbs., and the oil per 1,000 is not in excess of 4½ gallons. The candle power is 20, and the pipes and connections around the works are, to use the Superintendent's own words, "just as clean as when they were put in."

The following matter, which explains itself, is to be taken in connection with our prior reference thereto in our issue for Jan. 29:

The Consumers' Gas Company, of Toronto,
Toronto, Ontario, 7th Feb., 1894.

To the Editor American Gas Light Journal: As it may be a matter of interest to you, I inclose clipping from the Toronto *Globe* of 20th January last, giving a summary of the recent decision of the County Judge with regard to the assessment of our street mains. In order to have a proper understanding of the case, I give you the following extract from the Ontario "Consolidated Assessment Act" of 1892, from which you will see the reason gas companies claim exemption from taxation on their mains—the point at issue is, of course, whether street mains are personal property or realty: "The personal property of a bank or of a company which invests the whole or the principal part of its means in gas works, water works, plank or gravel roads, railway and tram roads, harbors or other works requiring the investment of the whole or principal part of its means in real estate, shall, as hitherto, be exempt from assessment; but the shareholders shall be assessed on the income derived from such companies." I may say that our Company intends to resist the payment of these taxes, so that the matter may be appealed to a higher court. The County Judge, of Welland, has allowed the St. Catharine's Gas Company's appeal against the assessment of its street mains, as also has the Judge for the County of Elgin, with regard to the St. Thomas Gas Company, the conclusions at which they have arrived being exactly opposite to those of Judge McDougall.

Yours truly,

W. H. Pearson, Gen. Mgr. and Sec.

The inclosure mentioned by Mr. Pearson is appended:

"Some of the most important judgments relating to the assessment law that have been delivered in recent years were handed down by the County Judge yesterday, in connection with the appeal of the Consumers Gas Company. * * * * The city has hitherto never succeeded in assessing the gas mains extending under the public streets, it being generally believed that to do so would not be upheld by the Courts. Last year, however, Mr. Maughan, acting on the advice of the City Solicitors' Department, given after careful study of a decision rendered nearly 30 years ago by the Carleton County Judge on a similar case, decided to assess the Gas Company to the extent of $500,000 on its mains. As was expected, appeal was made, on the ground that the mains were on the public highway, and that the corporation had no right or jurisdiction to assess property so situated. As the appeal to the County Judge is final in assessment cases the judgment was looked forward to with considerable interest. The following are the more important points, including the summary: 'I have had much difficulty in arriving at a satisfactory conclusion in this case. The mains of the Gas Company are undoubtedly part of their plant and machinery, fixed to the land; and to the extent that the mains extend under the soil and land actually owned by the Company are land at common law, and under sub-section 9 of section 2 of the assessment act. These mains extend beyond the boundaries of the Company's own lands, and into and under the highways and streets of the city; there is no break in their continuity; and they form, with the gas works, one undivisible set of plant necessary for the purpose of their business, in order to enable them to convey gas to their consumers. The particular assessment appealed from has been made at the principal place of business of the Company, where the manufacturing of gas is conducted. The estimated value of these mains, $500,000, has been added to the value of the fixed machinery located on the Company's own lands, and the whole assessment as levied has been laid upon the land, buildings, plant and machinery of the Company at Parliament street. This is not an assessment, in name at any rate, upon the portions of the highways occupied by the mains themselves, and there is no legal difficulty that I can discern in levying and collecting the taxes based upon the whole assessment. A warrant directed against the Company's property to realize the taxes could be levied upon the Company's premises, and, in case a sale should become necessary, their lands, buildings, plant and machinery could be sold; and under such rate the Treasurer's deed of the whole property would, no doubt, pass to the purchaser of the gas works, the fixed machinery, and would include the mains as part of the general plant. To summarize: I think the Consumers' Gas Company are liable to the assessment made, on the following grounds: (1.) Their mains may be well assessed as machinery, forming an undivisible part of their plant, and appurtenant to the lands actually owned by them. (2.) Sub section 7 of the interpretation clause of the municipal act is to be read into the assessment act, and in that case an assessment is expressly named as a taxable interest, and if the Gas Company's interest in their mains is only an easement, it is expressly assessable. (3.) That even if this clause of the municipal is not to be read into the assessment act, the words 'real property' and 'real estate,' now used in the assessment act, cover and include an easement. (4.) That the interest or estate of the Gas Company in the mains and soil is more than the easement—it is a hereditament, and as such taxable as land. (5.) That, though land in the public highways, the mains are not exempt, for the property so conferred is created by act of Parliament, and in the absence of express bonds of exemption, their property or estate, like that of other Companies, must be taken to be liable to taxation. The exemption of highways and streets from taxation should be strictly construed and confined to the interest of the Crown and municipality therein."

Mr. E. W. Hamlin has leased the Wilmington (Ohio) Gas Works to the J. W. McClurg Gas Construction Company, of Pittsburg, Pa., for a term of years. The lessees will make extensive alterations in and additions to the plant, and have given the partial promise that when the works are perfected the selling rate will be put at $1 per 1000 cubic feet. The resident managers of the McClurg Company will be the Messrs. Miller. Of course it is understood that Mr. Hamlin retains the ownership. These works were constructed in 1872, by Mr. R. T. Coverdale, who subsequently sold the plant to Mr. S. F. Covington, and by him sold to Mr. E. W. Hamlin, in 1879.

The trouble at the Biddeford (Me) gas works, occasioned by a 10 per cent. reduction in the wages of the workmen, who insisted that they would not continue their labors if the cut was insisted on, has been

averted through the promise of the proprietors that the wages will be restored when the business of the Company warrants.

THE proprietors of the Newburyport (Mass.) Gas and Electric Company, in response to the request of the Mayor for cheaper rates, reply that it will be impossible to make any reduction the present year.

REPRESENTATIVE HAMMOND, of Quincy, has introduced a bill in the lower branch of the Massachusetts Legislature authorizing the consolidation of gas light companies, when agreed to by two thirds in number and interest of the stockholders of each company; the capital stock of the consolidated company shall be a sum equal to the value of the property of the constituent corporations, the shares to be of the par value of $100; the market value to be determined by disinterested appraisers, one of whom shall be appointed by the Supreme Judicial Court.

THE following is the text of the ordinance regulating the rates that may be charged for gas in the city of Toledo, O., for the ensuing 10 years:

Section 1. Be it ordained by the Common Council of the city of Toledo that Companies furnishing gas for illuminating purposes in the city of Toledo, may charge therefor not to exceed $1 per 1,000 cubic feet, from January 1st, 1894, to January 1st, 1899, and not to exceed 95 cents per 1,000 cubic feet from January 1st, 1899, to January 1st, 1904, said gas to be 18 candle power, which prices are hereby fixed for illuminating gas of 18 candle power for a period of 5 years each, as above specified; provided that when bills for gas remain unpaid for a period of 10 days after presentation, said Companies may charge and collect therefor at the rate of 15 cents additional per each 1,000 cubic feet; provided, further, that said Companies or Company shall light free of charge the City Council Chamber, City Engineer's, Clerk's, Solicitor's, Auditor's, and Mayor's offices, and the central police station and sub-station; and provided, further, said Companies or Company shall furnish gas to the city fire engine houses free of charge in an amount not to exceed $500 per annum.

Sec. 2. No charge shall be made for gas furnished for illuminating purposes of less than 18-candle power, and no Company furnishing gas under this ordinance shall charge for adjusting the meter (including the lead tubing, meter cock, wrench, and all other material and labor) a sum greater than the following, to wit:

For a No. 3 or 5-light meter	$2 50
" " 10-light meter	3 15
" " 20 "	4 40
" " 30 "	5 00
" " 45 "	6 25
" " 60 "	6 90
" " 80 "	7 50
" " 100 "	9 40
" " 150 "	11 25

Provided no Company furnishing gas under this ordinance shall make any charge for resetting a meter or setting a meter in the same place from where a meter has been removed by said Company.

Sec. 3. Every Company furnishing gas under this ordinance shall first comply with section 3,561 of the Revised Statutes of Ohio, and no Company furnishing gas under this ordinance shall be required to render a bill in any month when the amount of gas consumed in that month is less than 200 cubic feet, but may make a service charge of 25 cents in lieu of said bill and in full payment of said amount of gas so used in said month.

SEC. 4. When any Company shall file with the City Clerk its acceptance in writing of the terms hereof, as provided in Section 2,479 of the revised statutes of Ohio, this ordinance and such acceptance shall be deemed a compliance with Sections 2,478 and 2,479 of the revised statutes of Ohio, and after such acceptance said Company or Companies shall not be compelled by said Common Council to furnish illuminating gas at a lower price than herein named during the terms for which such price is fixed.

The last section provides that the ordinance shall take effect and be in force from and after its passage and legal publication. The ordinance received the assent of the Mayor and was first published on February 6th.

SOME days ago Edward S. Wood petitioned the Massachusetts Legislature for the passage of an act to reduce the dangers attending the use of illuminating gas. He suggests that every owner, proprietor or lessee of a hotel or lodging house place or cause to be placed some appliance for the prevention of the escape of gas from unlighted gas burners in every room, after January 1, 1895, and that any person violating the provisions of the act be punishable by a fine of not more than $500, or by imprisonment in the county jail not exceeding 6 months, or both.

THE projectors of the Nanticoke (Pa.) Gas Company, a charter for which was recently granted by the State, have applied to the Council for a franchise, and the application was referred to the Ordinance Committee.

MR. COOPER, of Indiana, who is a member of the Congressional House Committee, District of Columbia, says he intends to push his bill putting the price of gas in Washington at $1 per 1,000 cubic feet. In the meantime it looks that the majority of the Committee in the District are disposed to consider the present gas rate in Washington a reasonable one.

AT a meeting of the Chelsea (Mass.) Common Council, a petition signed by Geo. Babson, Oliver H. Perry and A. B. Champlin was read, in which they asked for permission to lay and maintain pipes in all the streets of the city for the purpose of supplying illuminating gas at a cost of not more than $1 per 1,000 cubic feet, and they also asked for a hearing before the full Board instead of a committee. On motion of Alderman Baker, the hearing was set for 8:30 P. M. to morrow.

THE Sub-Committee of the House Appropriations Committee, District of Columbia, has authorized the appointment of an additional Inspector of Street Lamps for Washington, at a salary of $900.

THE set of water gas apparatus erected by the U. G. I. Company at the works of the Altoona (Pa.) Gas Company was fired up on the 5th inst. The trial run was in all respects satisfactory.

JOSEPH CAIRE, who had been in the employ of the Poughkeepsie (N.Y.) Gas Company for some time, is dead. He was a young man of much promise.

THE Directors of the Jamaica Plain (Mass.) Gas Company have declared an extra dividend of 2 per cent., which makes the total return for the year equal to 10 per cent.

IT is reported that Mr. A. B. Eilbeck, Superintendent of the Consolidated Gas and Electric Light Company, of Portchester, N.Y., has resigned from the Company's service. His successor is Mr. F. A. Coffin.

A NEW boiler will be placed in the City Gas Works, Bellefontaine, Ohio.

A DESPATCH from El Dorado, Kansas, is to the effect that the El Dorado Light and Fuel Company, to manufacture and sell illuminating and fuel gas, in El Dorado, has been incorporated by Rudolph Hatfield, O. H. Bentley, Hiram Burnett, W. G. Nomey and R. E. Lawrence, all of Wichita. The capital is $75,000.

THE Legislature of Maryland, will be asked to pass a bill authorizing the city of Baltimore to tax the gross receipts of the Consolidated Gas Company in the sum of 9 per cent. per annum for its "use of the bed of the streets."

THE Steubenville (Ohio) Gas and Electric Company has notified its electric consumers that the price for incandescent electric lamps (renewals) until further notice shall be as follows: 16 candle power, 45 cents each; 25 candle power, 50 cents; 32 candle power, 65 cents; 50 candle power, 95 cents. The prices hitherto charged were: 16 candle power, 55 cents; 25 candle power, 65 cents; 32 candle power, 80 cents; 50 candle power, $1.10.

THE plant of the Beverly and Edgewater Park (N. J.) Electric Light and Power Co. was sold at receiver's saleby order of Chancellor McGill. The plant, which originally cost $18,000 was disposed of for $873.50.

IT is again rumored that the Lowell (Mass.) Gas Company is about to absorb the local electric light company. Better far to keep on selling gas only at $1 per 1000.

AT a meeting of the Philadelphia Councils' Committee on Gas it was agreed to postpone the consideration of the Schanz ordinance, looking to the purchase by the city of the Northern Liberties gas works, until February 27th, when a meeting will be held at which the Director of Public Works, City Controller, Chief Engineer Park and others interested in the matter have been invited to be present.

The Market for Gas Securities.

Consolidated gas is steady at 125, but the demand for the shares is slight. The feeling of uncertainty respecting the attitude of the Albany law makers to dollar gas is marked, although in the belief of those best qualified to give a sound opinion the bills cutting rates will not become laws this year. In that event Consolidated is cheap. Mutual is strong at 148 bid, and Equitable is offered at 185. Standard preferred is quiet and steady. Brooklyn shares are quiescent, although Nassau, Metropolitan and Fulton-Municipal are held at pretty steep figures. There is nothing new in the situation there, unless it be that the Equity Company bondholders are better fortified in their position by the recent decision of the Court of Appeals. Chicago gas is a trifle stronger, mainly because of the failure of the Council to pass the Metropolitan opposition ordinance over the veto of Mayor Hopkins. Baltimore Consolidated is buoyant, at 58½ to 59, and we again call attention to these shares as a purchase. It is not at all improbable that some "friends" of Senator Gorman have acquired good holdings in the Company, hence our belief that immediate hostile legislation is not to be feared. Bay State is stronger, at 17 bid.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

February 19.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	125	125½
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	180	185
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	148	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	50	65
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	32
Preferred	5,000,000	100	—	77
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	110
Citizens	1,200,000	20	55	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	25	40
Fulton Municipal	3,000,000	100	137	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	80	83
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	—	140
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	160	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	135	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	17	—
Income Bonds	2,000,000	1000	40	—
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	78	—
2d " " "	3,000,000	1000	57	58
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	64⅜	64¾
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	27	33
Bonds	600,000	1000	85	88
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	58½	59
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			56	—
East River Gas Co., Long Island City	1,000,000	100	—	—
Bonds	500,000	100	89¼	—
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	15½	16
Preferred "	2,500,000	100	61	63
Bonds	9,034,400	1000	—	84
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	30	—
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			42⅜	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105

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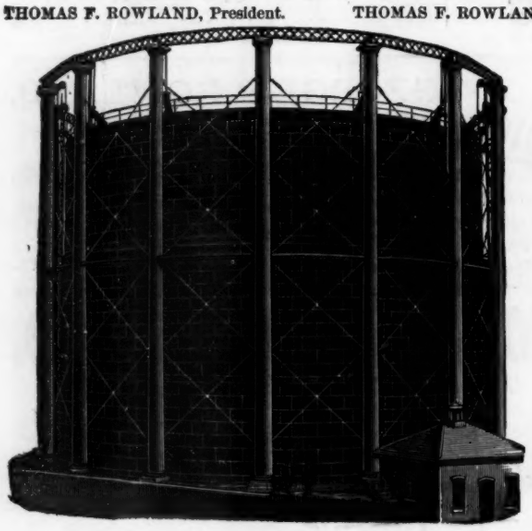

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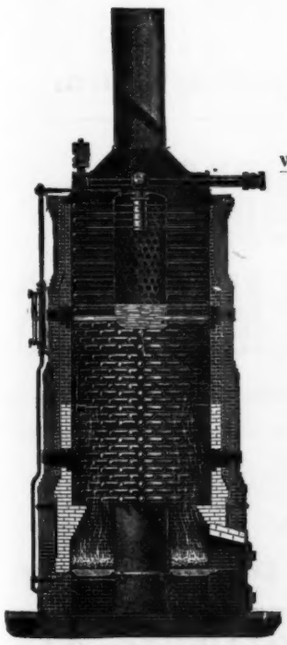

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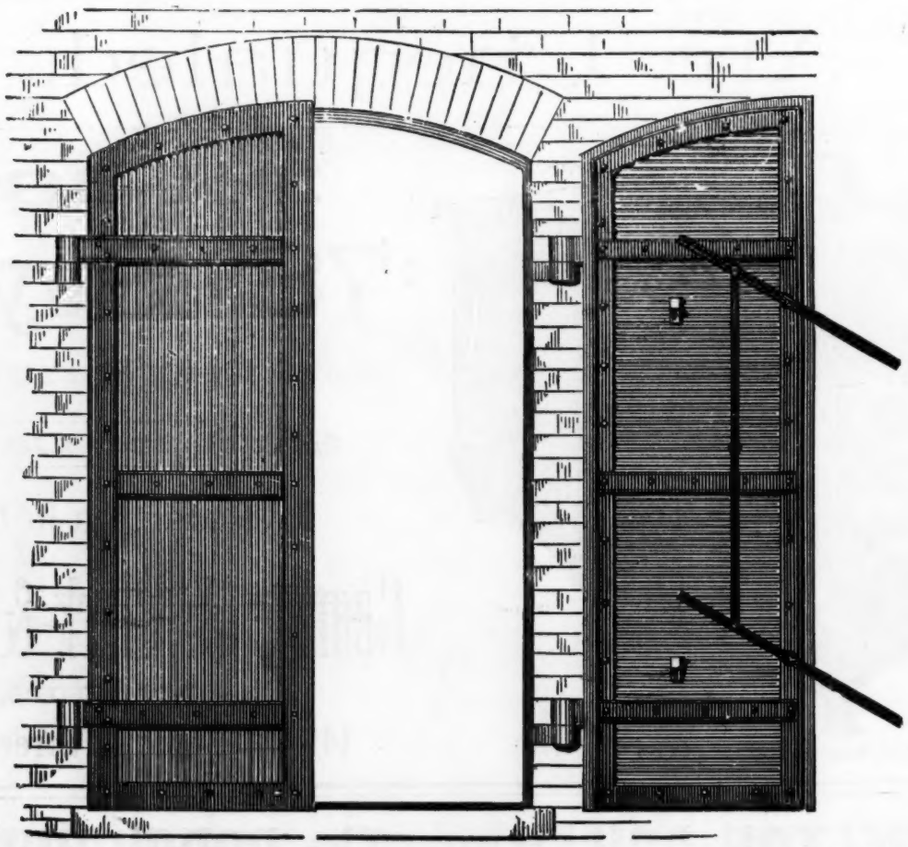

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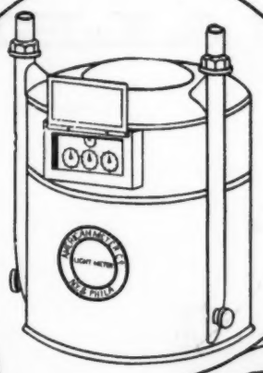

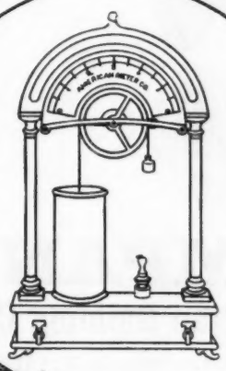

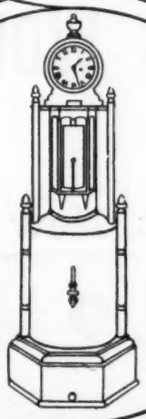

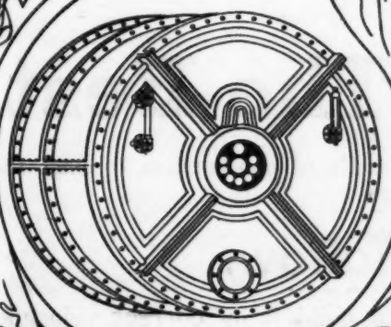

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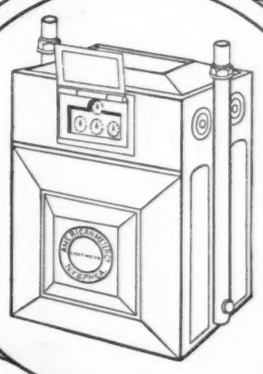
PUBLIC LIGHTING TABLE.

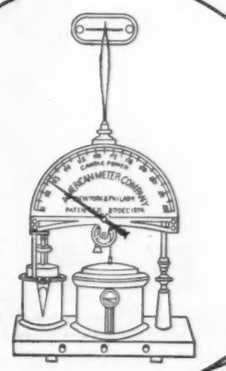
MARCH, 1894.

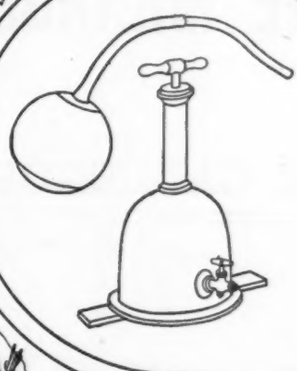
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	6.20 PM	5.00 AM	5.30	5.45
Fri.	2	6.20	5.30	5.30	5.45
Sat.	3	6.20	5.30	5.30	5.45
Sun.	4	6.30	5.30	5.30	5.45
Mon.	5	6.30	5.30	5.40	5.35
Tue.	6	6.30	5.30	5.40	5.35
Wed.	7	6.30 NM	5.20	5.40	5.35
Thu.	8	6.30	5.20	5.40	5.35
Fri.	9	6.30	5.20	5.40	5.35
Sat.	10	6.30	5.20	5.40	5.35
Sun.	11	6.30	5.20	5.40	5.35
Mon.	12	11.00	5.20	5.50	5.20
Tue.	13	12.20 AM	5.20	5.50	5.20
Wed.	14	1.20 FQ	5.10	5.50	5.20
Thu.	15	2.20	5.10	5.50	5.20
Fri.	16	3.10	5.10	5.50	5.20
Sat.	17	3.50	5.10	5.50	5.20
Sun.	18	4.20	5.10	5.50	5.20
Mon.	19	No L.	No L.	6.00	5.10
Tue.	20	No L.	No L.	6.00	5.10
Wed.	21	No L. FM	No L.	6.00	5.10
Thu.	22	6.50 PM	8.40 PM	6.00	5.10
Fri.	23	6.50	9.50	6.00	5.10
Sat.	24	6.50	11.00	6.00	5.10
Sun.	25	6.50	12.00	6.00	5.10
Mon.	26	6.50	1.10 AM	6.10	4.55
Tue.	27	6.50	2.00	6.10	4.55
Wed.	28	6.50	3.00	6.10	4.55
Thu.	29	6.50 LQ	3.40	6.10	4.55
Fri.	30	6.50	4.20	6.10	4.55
Sat.	31	6.50	4.40	6.10	4.55

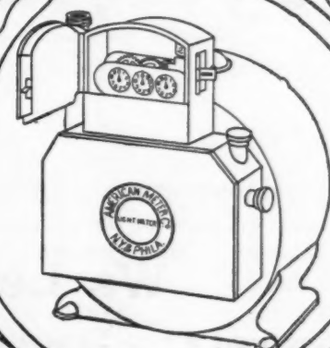
TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45









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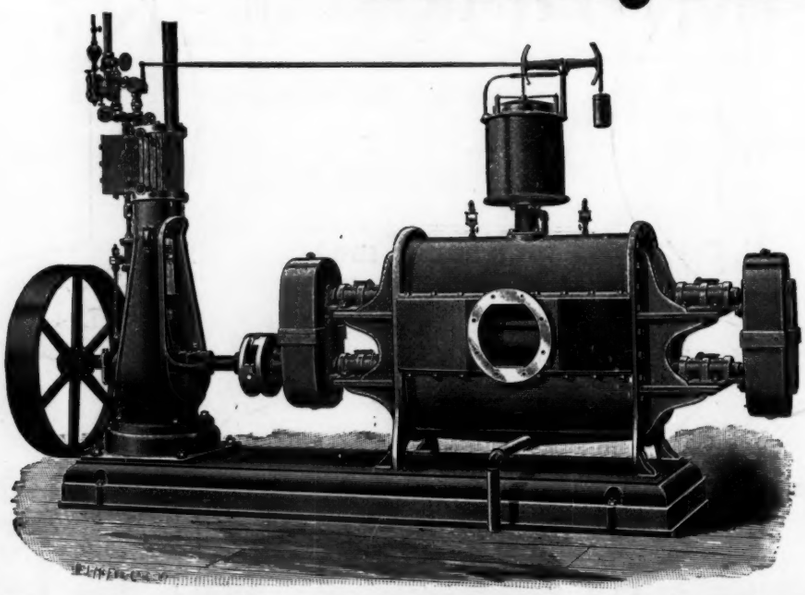

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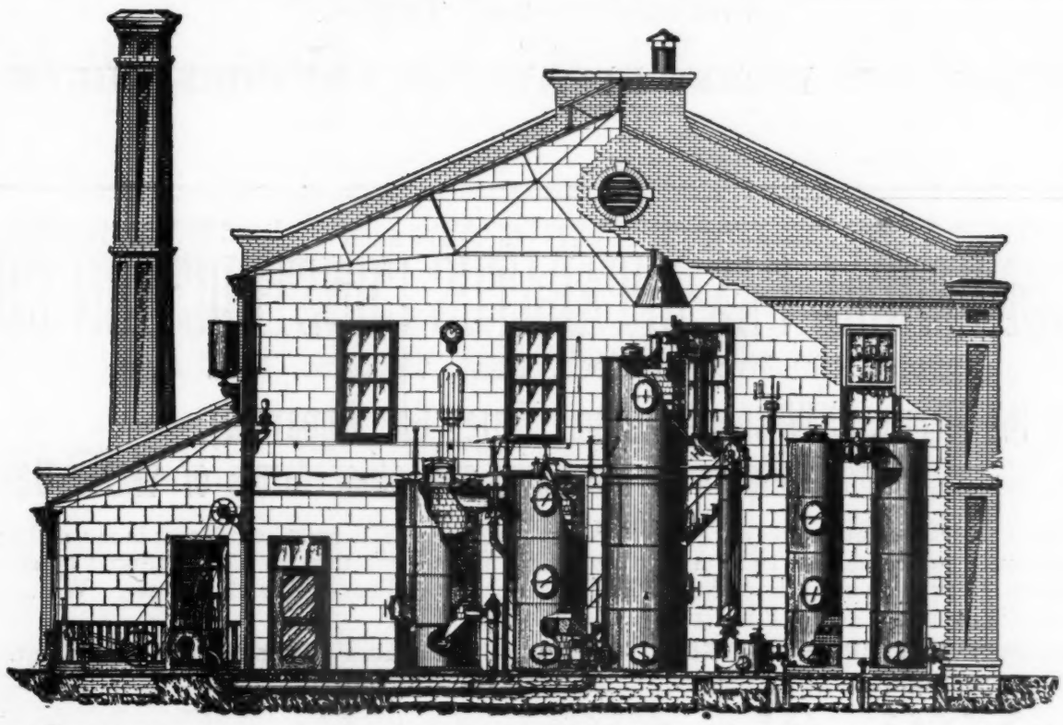

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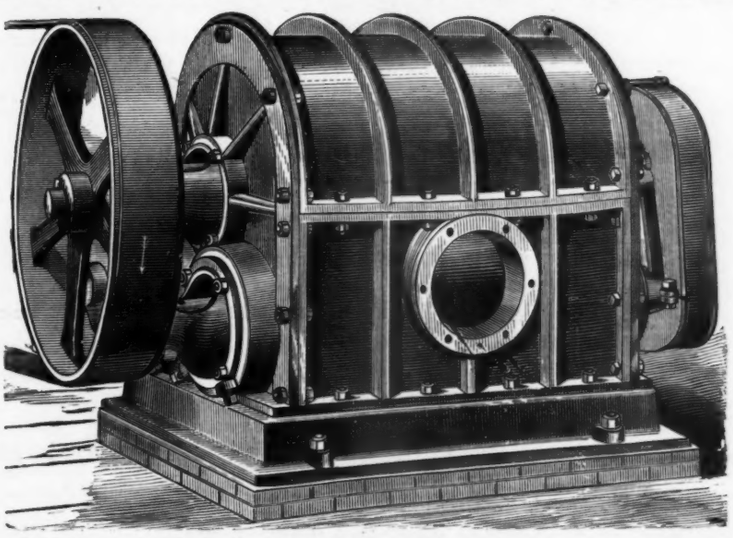

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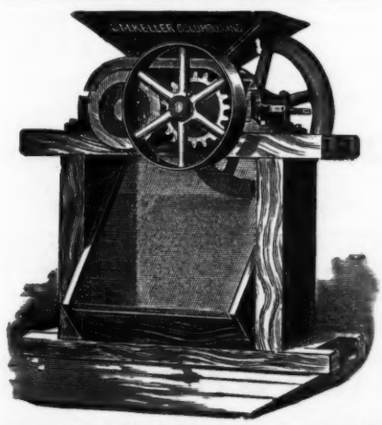

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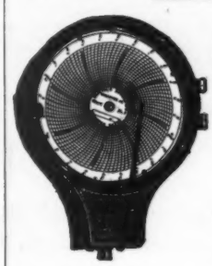

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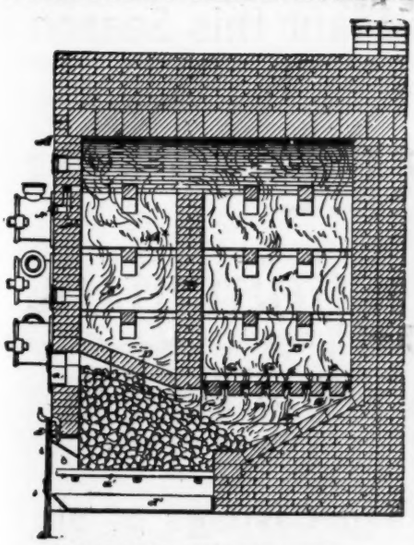

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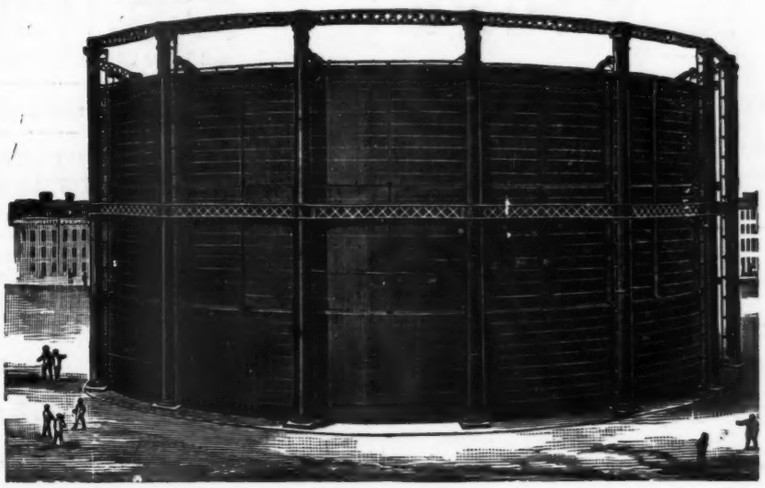

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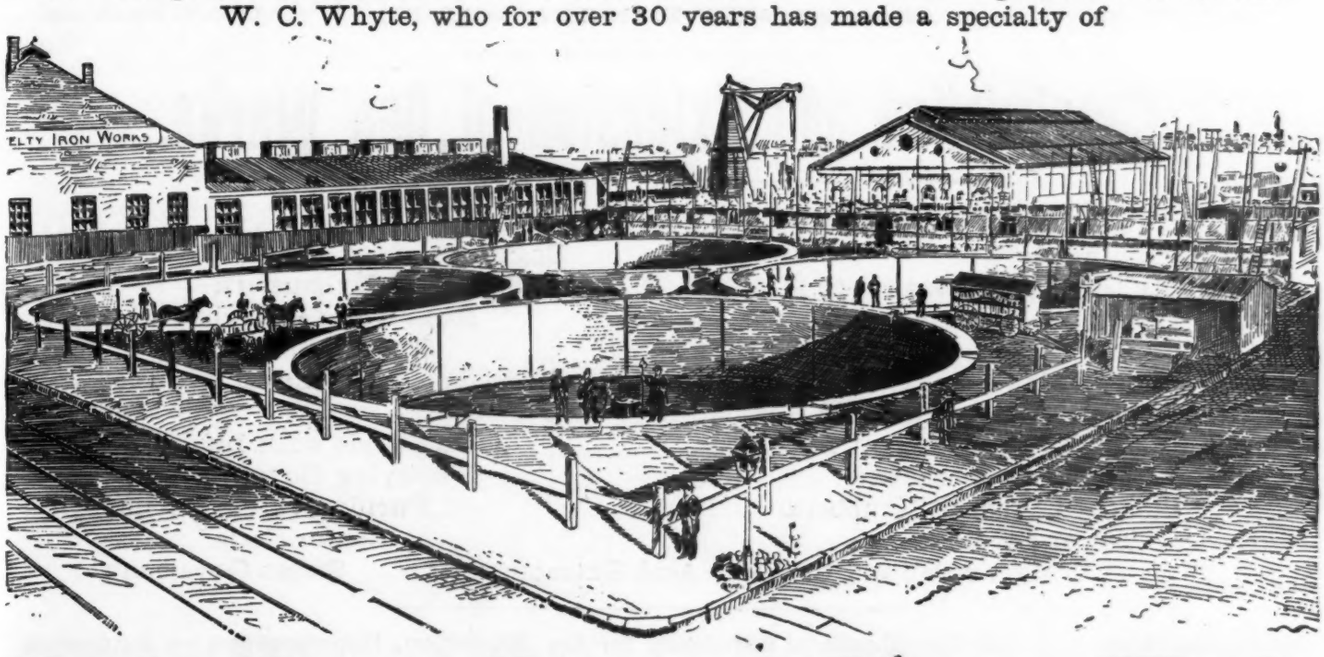

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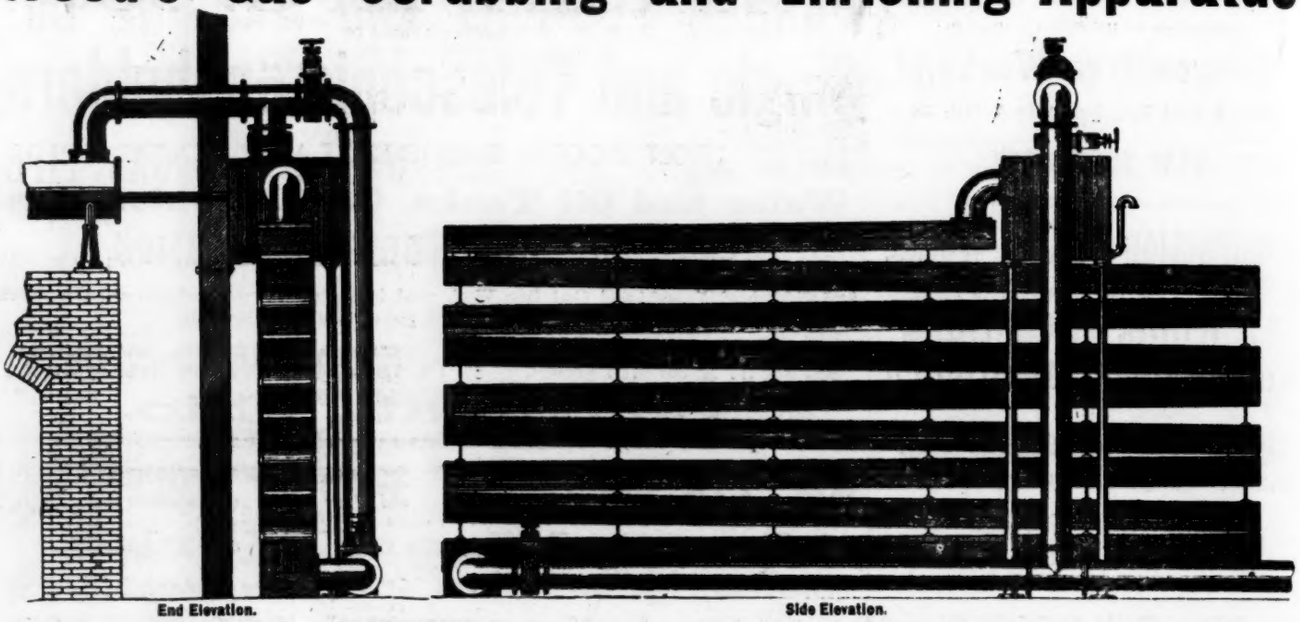

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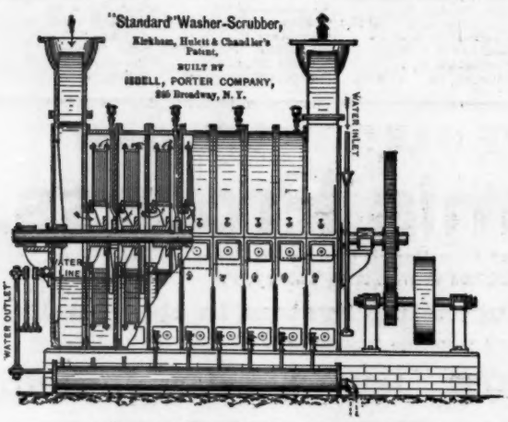

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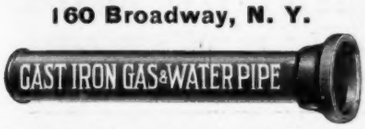

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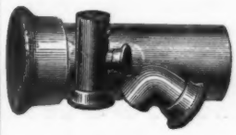

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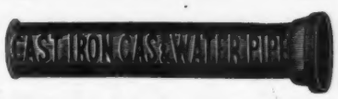

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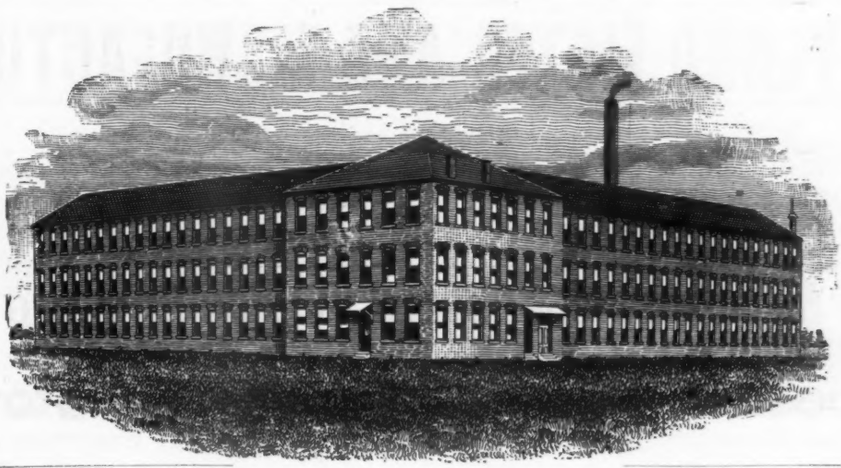

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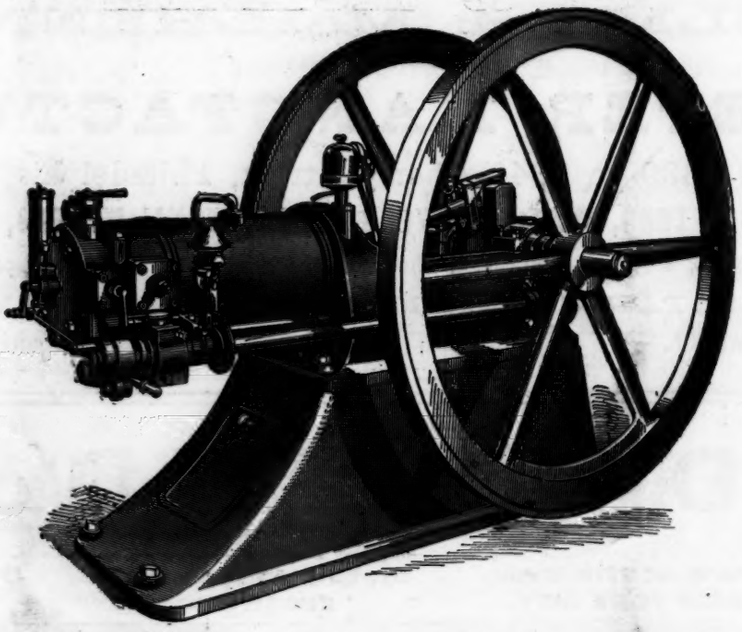

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